He who dies with the most toys…
A longitudinal look at materialism and physical health

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Abstract

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Despite decades of tremendous economic growth, health and longevity in the US has largely stalled in comparison with other high income countries. Traditional risk factors, such as access to healthcare, do not entirely explain this phenomenon leading some to question whether aspects of the US culture should be investigated. Materialism, an often cited characteristic of US culture, has been increasing since the 1960s and a growing body of research suggests materialism may harm psychological well-being and mental health. This dissertation investigated the association between materialism and physical health in order to determine whether materialism should be considered further as a potential explanation for the stalling health in the US. This study was conducted in three parts: a systematic review of the existing literature, an analysis of the association between materialism and self-reported health and chronic medical conditions, and a survival analysis to assess whether materialism affects longevity. The systematic review of the materialism literature identified gaps pertaining to the effect of materialism on physical health in particular. Overall, the analytic papers found little support for a meaningful effect of materialism on self-reported health, chronic medical conditions, or mortality. In addition, there was no support for meaningful mediation by psychological needs or effect modification by household income or education. However, there was some suggestion that materialism may affect self-reported health among young adults born in the 1970s and 1980s. Further research is needed to rule out a chance association and to monitor these young adults for health effects in later life.

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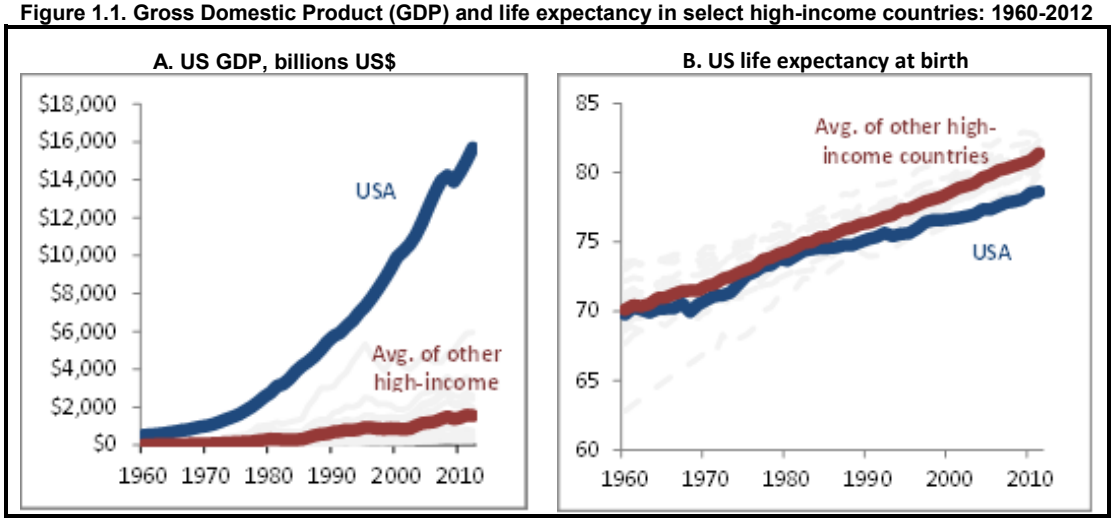
Chapter 1. Introduction

"He who dies with the most toys wins" –*US bumper sticker*

The United States has enjoyed a staggering amount of economic growth over the past 50 years; its gross domestic product (GDP) has grown from $520 billion in 1960 to $15.7 trillion in 2012 (see Figure 1.1A, blue line). In comparison, the average GDP of similar high-income countries increased from $22 billion (US$) to $1.5 trillion during that same period.[1] However, health and longevity in the US has not seen such dramatic gains and, despite spending more money on healthcare, it appears to be stalling in comparison with those same high-income countries (see Figure 1.1B, blue line).[2] The differences in health are not limited to specific problems; Americans have higher mortality from infancy to late adulthood, are more likely to have diabetes, heart disease, lung disease, and are more likely to be killed in a car crash or murdered.[3,4] This pattern of worse health is not limited to the poor or uninsured either; all groups of Americans appear to be affected including the rich, the educated, and the insured.[3] The most obvious potential explanations have been proposed, such as access to healthcare, health behaviors, and socioeconomic conditions, but none have been able to satisfactorily explain the trends across so many different health outcomes and such a variety of people. This led several researchers to propose that the traditional risk factors, e.g. healthcare and socioeconomic status, may combine with

Figure 1.1. Gross Domestic Product (GDP) and life expectancy in select high-income countries: 1960-2012



World Bank Open Data: http://data.worldbank.org/?display=graph. Countries: Australia, Austria, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States. Individual country data in light grey except US.

policy, social and behavioral factors to affect health.[3,4] This dissertation intended to investigate materialism, one aspect of US culture, and its potential to impact physical health.

Materialism, or valuing money and possessions more than relationships and self-development, is often thought to be increasing in the US; however, clear evidence to support this is surprisingly difficult to find. When considering an individual's earning and spending, it is difficult to tease out what may be due to materialism and what may be simply due to inflation. When considering how much time Americans spend working or shopping, insufficient data are available to distinguish someone who works or shops because they want to be rich or have more possessions from someone who is working long hours to avoid being laid off or shopping a lot because they support a large family. However, several statistics indicate increasing materialism, at least to some degree. For example, among American college freshmen, the proportion considering financial success as very important or essential nearly doubled from 42% in 1966 to 81% in 2012,[5,6] with most of that increase occurring in the 1970s. One might argue that economic factors may have caused this increase; however, the proportion of students valuing financial success has remained high through prosperous times and recessions. Moreover, the proportion of students who considered developing a meaningful philosophy in life as very important was nearly halved during this same period.[5,6]

American consumption patterns have also changed over time, but, again, it is difficult to separate changes driven by materialism from, say, changes in the availability and affordability of new technology. However, some consumption is likely materialistic. For example, it is difficult to explain why a household might need five or more televisions, yet the proportion of US households meeting that criteria grew from less than 2% in 1993 to nearly 9% in 2009.[7,8] Overall, as is often suggested in popular literature, American values and consumption do appear to be changing and may be symptoms of societal factors that could impact health. As suggested by prior researchers,[9,10] materialism is a potential risk factor that should be explored.

Materialism has been at the center of a growing body of literature in psychology and consumer research; it has been associated with more depressive symptoms and anxiety,[10-16] more physical symptoms,[14,16-21] lower life satisfaction,[22-24] and other forms of lower psychological well-being.[11,25-32] The literature appears relatively consistent and most studies seem to observe a harmful association between

materialism and a variety of outcomes; however, no systematic review of the literature has been published since 1993[33] and much of the current literature has been published in the years since.

When determining whether materialism should be considered as a potential contributor to the US trends in physical health, several gaps in the literature become clear. The majority of the research has focused on mental and psychological health outcomes; physical health outcomes have often been limited to psychosomatic symptomology. This provides little evidence to support or refute materialism's potential to affect more serious physical health problems. The existing studies have largely been cross-sectional in design, making it difficult to determine whether the materialistic values measured actually precede the outcomes; poor psychological health may lead to the development of materialistic values.[10,34,35] It is important that the temporality of the association be established. Many of the studies were limited to convenience samples, often university students, limiting the generalizability of the results; because the interest here was in whether materialism may impact the health of the nation, results that apply to a more diverse population are needed. Finally, and possibly most important from an epidemiologic perspective, many studies did not control for potential confounders, particularly socioeconomic status. Overall, the limitations of prior research limit serious consideration of materialism as a risk factor for health in the US population.

This dissertation aims to build on existing studies while addressing many of the common limitations. This project was divided into three parts: a systematic review and two analytic papers investigating the effect of materialism on distinct physical health outcomes. First, the review of the materialism literature, Chapter 2, was conducted in order to provide a systematic assessment of the current state of the research on the association of materialism with mental and physical health outcomes, and assess the various limitations in existing studies. Next, two analytic chapters evaluated the impact of materialism on physical health outcomes. Using data from a 30-year cohort study of multigenerational families,[36] Chapter 3 estimated the effect of materialism on self-reported health and chronic medical conditions. Chapter 4 followed with a survival analysis of respondents who participated in the first 20 years of the study. This dissertation aimed to provide evidence for the association of materialism and physical health and to make recommendations for future research.

Chapter 2. Materialism and health: A systematic review of the effects on mental and physical health

2.1 Abstract

Background: Despite decades of economic growth, health in the US has largely stalled leading some researchers to suggest aspects of US culture should be investigated. Materialism, a well-recognized aspect of US culture, has been gaining attention among psychological and consumer researchers, but has been essentially ignored by epidemiologists. *Purpose:* This paper aims to systematically review the materialism literature to identify gaps and to determine whether there is sufficient evidence to consider materialism as a risk factor for poor health. *Data sources:* Ovid MEDLINE, PsycINFO (Ovid), and Web of Knowledge were searched for English-language publications between January 1980-June 2013. Search terms included materialism, extrinsic or intrinsic motivation, goals, or financial aspirations in combination with health or well-being. Additional publications were identified via the reference lists of relevant articles found in the database search. *Study selection:* All study designs in naturalistic settings using adult samples from high-income countries were assessed for eligibility. Studies were included for review if materialism was measured as a values system or the importance of at least one materialistic goal and eligible outcomes included indicators of psychological well-being, psychiatric diagnosis or symptoms, or medical diagnosis or physical symptoms. *Data extraction:* All data extraction was conducted by the author. *Data synthesis:* Insufficient data were available to conduct typical analyses for systematic reviews, such as assessments for publication bias; therefore, a more narrative approach used frequencies of study and test characteristics across categories of study results. Generalized linear mixed-effects modeling approaches helped identify the most influential factors. *Results:* Forty-six publications were included in the review, reporting 232 test results from 74 distinct studies. The majority of test results (82% unadjusted correlations and 95% adjusted coefficients) were in the hypothesized direction (i.e. materialism had a harmful effect on health); 50% and 62% of unadjusted and adjusted results achieved statistical significance, respectively. The characteristics most strongly associated with results supportive of the hypothesized effect were the specific constructs of materialism and health measured, and sample size. Age and gender of respondents, geographic region of the study, and several methodological characteristics were no longer associated with study results after controlling for other characteristics.

When limited to the studies investigating the effect of materialism on physical symptoms, 16 of 17 observed associations in the hypothesized direction, eight of which were statistically significant. *Conclusions:* There is sufficient evidence to suggest a harmful effect of materialism on health in general. Furthermore, results, though limited, support an association between materialism and physical health justifying additional research using epidemiologic methods.

2.2 Background

Over the past 50 years, the US economy has grown tremendously with a gross domestic product (GDP) rising from less than $1 trillion to over $15 trillion in 2012.[1] However, despite spending 17.9% of the total GDP on health expenditures,[2] the US compares poorly with other high-income countries in life expectancy, cardiovascular morbidity, and other health outcomes.[37] While several explanations have been suggested, such as access to health care and socioeconomic conditions, several researchers have asked whether particular aspects of US culture may explain this trend.[4] Materialism, a well-recognized aspect of US culture, may be one such factor.

Materialism has received little attention from epidemiologists as a potential risk factor for poor health outcomes or to help explain larger national trends in health (see Eckersley[9] and Cohen and Cohen[10] for exceptions). Yet, materialism has been the focus of a growing body of research in psychology and consumer research investigating its effects on mental health and physical symptomology. This research appears to be relatively consistent in finding a detrimental effect on psychological and physical outcomes. However, many of the studies may be limited by cross-sectional study designs, convenience samples, and little control for potential confounders, though the impact of these factors has not been systematically assessed. The purpose of this paper is to systematically evaluate the materialism literature and to recommend directions for future research using epidemiologic methods. This paper begins with a brief overview of the current state of the literature followed by the methods and results of the systematic review. It concludes with a discussion of the implications of the findings for future materialism research.

2.2.1 Materialism measures

In the early 1990s, the introduction of two materialism scales, the Material Values Scale (MVS)[38] and the Aspirations Index (AI),[13] shifted much of the literature toward defining materialism as a value system. The first instrument, the Material Values Scale, was developed by consumer researchers Marsha Richins and Scott Dawson who defined materialism as "a set of centrally held beliefs about the importance of possessions in one's life."[38] It measures three themes common to theories and popular notions of materialism: the acquisition of material possessions as central to one's life, acquisition as a means to happiness and well-being, and the quantity and quality of material possessions as indicators of

one's success. The materialism score's reliability found in the original validation studies is good (α=0.80-0.88);[38] factor analyses have demonstrated the scale's 18 items fall under 3 factors consistent with the three themes described above (centrality: α=0.71-0.75; happiness: α=0.73-0.83; success: α=0.74-0.78).[38] A shorter 15-item version of the scale was developed in 2004 (overall α=0.79-0.91, centrality: α=0.54-0.77, happiness: α=0.70-0.83, success: α=0.72-0.84).[39]

The Aspirations Index, developed by psychologists Tim Kasser and Richard M. Ryan, also defines materialism as a set of values; however, the scale expands the materialistic values to include not only material possessions, but also financial success, fame or social recognition, and image (i.e. how one is perceived) or having an attractive appearance. These values are often referred to as extrinsic aspirations because they are generally motivated by external forces such as a reward or to avoid some penalty. In addition, the scale evaluates how materialistic values fit into the context of one's values overall by assessing the importance of non-materialistic or intrinsic goals, such as affiliation (relatedness or belonging), community feeling (working toward a better community), and self-acceptance (personal growth). The mean alphas for the extrinsic and intrinsic subscales were 0.76 in an adult sample and 0.82 in a sample of undergraduates.[18]

Several variations in materialism scores have been calculated from the Aspirations Index. In some studies, the relative importance of the extrinsic to intrinsic items is measured, often by subtracting the mean scores of one from the other (e.g. Schmuck 2000).[14] Other studies have used the average rated importance of only the extrinsic goals (e.g. Kasser & Ryan 1996)[18] or the importance of financial success alone (e.g. Kasser & Ryan 1993).[40] Other studies have used questions aimed at tapping into the same constructs as the Aspirations Index, but without using the instrument's items.[41] Taken together, the variation in materialism measures raises the question of whether the impact of materialism (if one exists) is dependent on the instrument used or the underlying conceptualization of materialism.

2.2.2 Outcome measures

An assortment of outcomes has also been used in assessing the impact of materialism. Psychologists have often focused on outcomes related to psychological well-being, such as self-actualization or positive and negative affect (emotional well-being);[18] their research has also included

mental health outcomes that may be more familiar to epidemiologists, including depressive symptoms or anxiety.[40] Researchers interested in a broader construct of well-being have also used measures for life satisfaction, a cognitive assessment of one's life in comparison to some self-identified standard,[42] as well as physical health, such as psychosomatic symptoms or vitality.[18] Given the diversity in outcome measures, it has become necessary, and now is possible, to begin exploring whether materialism may affect mental and physical well-being regardless of the outcome (or measure) used or if there are specific aspects of well-being that are more vulnerable to its effects.

2.2.3 Samples

In the early 1990s, respondents selected for study were primarily undergraduate students taking psychology courses in US colleges or universities,[18,40] with few exceptions.[38] More recently, study samples have expanded to include subjects from other countries and researchers have begun to use pre-existing data collected from large, representative samples, but many studies still use convenience samples of students or recruited through students. The generalizability of the results from these studies is questionable; perhaps certain characteristics of undergraduates, such as their age or stage in development, confound or moderate the association between materialism and health. This could lead to the appearance of a harmful effect that would not be found in other samples. Evaluating differences in the materialism-health association across various samples is critical for understanding any association that may exist in the larger population; in other words, if the association only exists among undergraduate students or young adults, it is unlikely to explain why health in the US is lagging behind health in other high income countries.

2.2.4 Purpose

Given the diversity of approaches and populations, a systematic review of the materialism literature is needed, but none has been published since 1993.[33] The purpose of this paper is to systematically review the empirical research on the relationship of materialism and mental or physical health among adults in high-income countries. Furthermore, this paper assesses whether variation in observed associations can be explained by methodological artifacts, e.g. the use of convenience samples, or if there are particular factors that may modify the true effect of materialism, such as the age of respondents.

2.3 Methods

2.3.1 Eligibility

All empirical study designs in naturalistic settings (i.e. cohort, case-control, and cross-sectional) were eligible for inclusion. Study samples had to include adults participants, 18 years and older; undergraduate students were assumed to be adults. Several samples of undergraduate students included respondents who were not yet adults; it was assumed the number of students under 18 was relatively small and would not affect the findings. Studies must have been conducted in high-income countries, with gross national income per capita of $12,616 or more, as categorized by the World Bank.[43] This eligibility requirement was intended to reduce contextual differences and increase the likelihood that materialism observed is due to the desire for greater status, rather than a desire for material resources to meet basic needs for survival, safety, or security. While the latter may still occur in high-income countries, it may be more likely to occur in countries with higher proportions of the population living in poverty or rapidly changing or growing economies. Studies conducted in multiple countries were reviewed if at least one country was high income and the results were reported separately by country. Only results from high income countries were included for review.

As discussed above, the literature consists of various definitions and measures for materialism; this review focused on materialism measured as a values system or the importance of specific materialistic goals, such as in the Material Values Scale[38] or the Aspirations Index.[18] The importance of the materialistic goals could be measured independently or in balance with the importance of non-materialistic, intrinsic goals as described by Kasser and Ryan (1993).[40] Additional details on exclusion criteria based on the materialism measure can be found in Appendix 6.1.1. Acceptable physical health outcomes included self-reported health, physical symptomology, health events, and stress-related measures (e.g. cortisol levels). Mental health outcomes included psychiatric diagnoses or symptoms, affective well-being (i.e. positive and/or negative emotions), self-actualization (a measure of psychological well-being by living up to one's potential[44]), and life satisfaction (a cognitive assessment of satisfaction with one's life).

Journal articles and book chapters indexed in the database searches were included if they were published in English between January 1, 1980 and June 30, 2013. This time period encapsulates the

development of materialism as a values orientation beginning with Richins and Dawson.[45] No limitations were made on the dates of data collection. Conference presentations, dissertations, and theses were not included; however, if the abstracts appeared to meet all other eligibility criteria, additional searches were conducted to identify subsequent published versions of the study.

2.3.2 Information sources

Three databases were searched for literature: Ovid MEDLINE®, PsycINFO (Ovid), and Web of Knowledge. The search was completed on July 4, 2013. Additional studies were found through searches of the reference lists of the empirical articles selected for review and other relevant articles that provided reviews of the literature (not necessarily systematic reviews) found in the databases above.

2.3.3 Search criteria

Wide search criteria were employed given the variation in terminology and outcomes used in materialism research across disciplines. Studies were included for further assessment if they used any of the following terms for the exposure: "materialism," "materialistic," "aspirations," "goals," "intrinsic motivation," or "extrinsic motivation." These terms were combined with "health," "well being" (or "wellbeing") and, whenever possible, limited to English language and published between 1980 and 2013. These search terms were expanded upon when additional terms within the database were deemed appropriate. See Table 2.1 for the full search criteria used in PsycINFO (OVID) database.

Table 2.1. Search criteria for PsycINFO (OVID)

(exp Materialism/	OR
materialism.mp	OR
materialism	OR
exp values/	OR
exp consumer behavior/	OR
materialistic.mp	OR
aspirations/	OR
exp goal orientation/	OR
exp goals/	OR
financial aspirations.mp	OR
exp Goals/	OR
intrinsic motivation.mp	OR
exp Intrinsic Motivation/	OR
extrinsic motivation.mp	OR
exp Extrinsic Motivation/)	
AND	
(health/	OR
exp mental health/	OR
exp physical health/	OR
well being.mp	OR
exp Well Being/	OR
wellbeing.mp)	

2.3.4 Study selection

Titles and abstracts of publications identified by the databases were then screened for eligibility. If potentially eligible, the full text was reviewed to either determine eligibility (when unclear from the abstract) or confirm eligibility. The same approach was used for additional publications identified through the reference lists of relevant articles.

2.3.5 Data collection process

Data were extracted from each study by the author using Excel. Data were collected on the study design, sample size, sample description including source and population demographics, information on the measures used for the exposure, outcomes, and covariates considered in the analyses. Results from correlation analyses were collected and converted to Cohen's d for comparison across studies.[46] Unstandardized regression coefficients were standardized when sufficient data (i.e. standard deviations of the exposure and outcome variables) were reported for calculation. Studies were rated for risk of bias from reverse causality, attrition, misclassification of either exposure or disease, and selection bias; studies were categorized as at low, moderate, or high risk. The risks of reverse causality, attrition and other selection biases were determined primarily by the study design. For example, cross-sectional studies were generally rated at high risk for reverse causality and low risk for attrition unless the study procedures provided justification for a different rating. Misclassification risks were based on the established validity of the measures, either by study authors or in previous literature, and reliability of the instrument in the study sample (low risk: $\alpha \geq 0.70$ & validated scale, moderate: either $\alpha < 0.70$ or scale has not been validated, high: $\alpha < 0.70$ and scale has not been validated; studies that did not report reliability were treated as if $\alpha < 0.70$). The level of confounder control was evaluated among the studies reporting adjusted analyses and categorized as minimal (adjustment for non-demographic or non-socioeconomic covariates only), moderate (adjustment for demographic or socioeconomic variables), and comprehensive (adjustment for both demographic and socioeconomic variables).

Within the literature, three levels of data were identified: publications, studies or samples, and statistical tests. Many of the publications reported findings from multiple studies (defined by a distinct sample) and, within each study, several hypotheses may have been tested. For example, in one article, Kasser and Ryan (1993) reported on three different studies (with distinct samples). Each study conducted 2-8 tests using various combinations of two measures of materialism and six different outcomes; overall, this publication produced 14 distinct results.[40] Results from two studies were published in multiple articles; unique results were combined as if each study was published in its own article. The analysis described below considered study-level and test-level factors.

The review begins with a description of the studies selected, followed by the frequency and distribution of study characteristics and potential risks for bias. The rest of the review focuses on the statistical test results. Separately, the unadjusted and adjusted test results were compared across potential methodological threats to internal validity: year of publication, the study design, sample size, sampling method, scales used, and risks of bias. Year of publication was considered to reflect changes in methodological approaches over time; it was not thought to represent cultural changes from the 1990s through 2010s that may lead to cohort effects. Cultural changes discussed in the literature were primarily pre- and post-1980s; none remarked on cultural shifts after the 1990s. In addition to the comparisons with methodological threats, the test results were compared by substantive sources of variation: geographic region, gender and age of respondents, and materialism and outcome constructs.

Overall, many of the studies' results were limited, often reported solely as correlations and p-values, preventing a thorough quantitative analysis. Therefore, this paper was intended to be primarily a descriptive review of the literature to identify potential sources of variation. However, several statistical methods were used to support the review. First, study results were standardized, whenever possible. Unadjusted correlation coefficients were converted to Cohen's d using the equation given by Cohen (1988, p.23);[46] unstandardized regression coefficients were multiplied by the ratio of the standard deviation (SD) of the exposure over the SD of the outcome to generate standardized beta coefficients. Not all studies provided the SDs for the exposure and outcomes; therefore, some studies' results were not standardized. Cohen's d is a standardized effect size that can be calculated from Pearson's r for easier comparison across studies. The formula used to calculate d[46] assumes that, had the samples been categorized into comparison groups, the groups would have been equal in size; this assumption cannot be tested with the available data. Cohen's d can be interpreted as the standard deviation change in the dependent variable given a one standard deviation change in the independent variable. Based on Cohen's suggestion, the effect sizes were categorized as small when $d<0.35$, medium when $0.35\leq d<0.65$, and large when $d\geq 0.65$.[46] Standardized beta coefficients have a similar interpretation and were categorized in the same manner. The effects were further categorized into three categories: effects that were statistically significant ($p<0.05$) and in the hypothesized direction (i.e. supported the hypothesis), non-significant effects regardless of direction, and significant effects in the opposite direction (i.e.

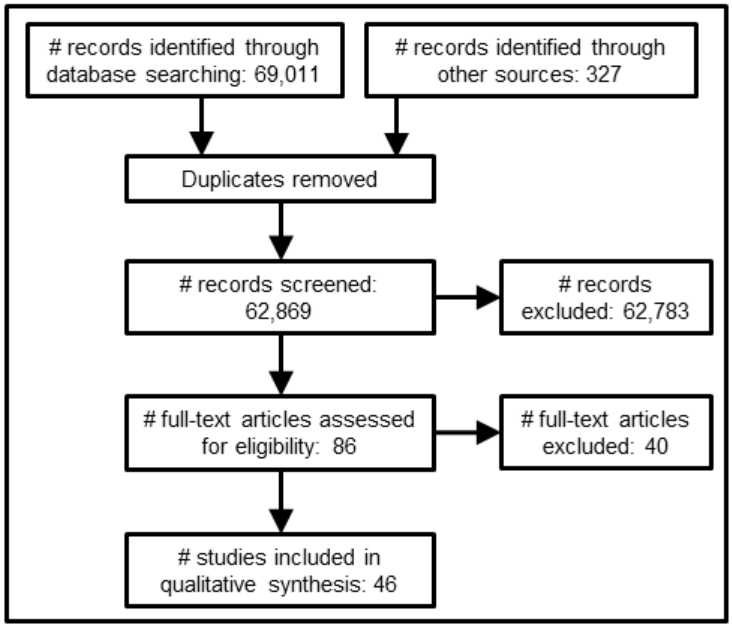
evidence against the hypothesis). The frequencies and distributions of these categories across study and test characteristics were evaluated; statistical significance was tested using generalized linear mixed-effects modeling for ordered response variables in a dataset in which there was one observation per test clustered by study. This approach was chosen because it controlled for the clustering of multiple tests with studies. This method assumes the effect of the independent variables (study and test characteristics) is the same when the dependent variable (study results) increases from -1 (unexpected) to 0 (non-significant) and from 0 to 1 (hypothesized). While not ideal, the number of tests with unexpected results (n=15, 7.5%) was too small to use the more appropriate multinomial modeling approach; however, this was deemed acceptable given the purpose of this analysis is solely to identify important characteristics and not to estimate their effect on the outcome.

The independent covariates achieving marginal significance were included in two adjusted models. The first included the threats to internal validity described above in order to eliminate methodological artifacts; the second model added the substantive variables as possible effect modifiers. For this analysis, the outcome variable was collapsed further so that the study results that achieved statistical significance and were in the hypothesized direction were compared with study results that were either non-significant or in the direction opposite the hypothesis. A multilevel mixed effects logistic regression model was used to conduct the analyses. This approach was chosen over the ordered logistic regression model used above because, unlike the simple associations with calculated frequencies described above, the direction of influence for each of the study covariates in the adjusted model may not have been as clear. For example, a variable associated with non-significant findings, but not unexpected findings (opposite the hypothesis), could have a negative coefficient. Because the ordered logistic regression model assumes the same effect, the direction of influence of the variable could be ambiguous; therefore, collapsing the outcome variable was a preferable approach. It is worth reiterating that this review intended to identify important study and test characteristics and not to estimate the magnitude of effect on the study results; the statistical techniques here are being used as tools in facilitating the process of identification.

2.4 Results

2.4.1 Article selection

Figure 2.1. Flow of publications selected for review



A total of 69,011 references were identified through the database searches; the large number of records was expected given the broad search terms used to capture research from a variety of disciplines. An additional 327 publications were found through searching the reference lists of relevant articles (see Figure 2.1). After removing the duplicates (6,469), the titles and abstracts of the remaining records were reviewed and 62,783 were excluded. After reviewing the full text, 40 records were excluded for the following reasons: inappropriate measure of materialism (25), inappropriate outcome (2), high-income country results were not separated from lower income countries (3), no main effect reported (2), not in English (2), duplicate study results (2), and unable to locate full-text (4). Of those excluded for the materialism measure, 14 measured non-materialistic values or goals or other measure that did not meet the definition for materialism, 6 used respondent-generated lists of goals, 3 defined materialism as personality trait, and 2 reported only the subscales from the Material Values Scale. Forty-six publications[11,14,16-26,38,40,47-77] were retained for review.

2.4.2 Study characteristics

While 46 publications were included in the review, multiple studies were sometimes reported within the same publication; therefore, 74 separate studies, defined by their distinct sample populations, were considered and reported below. The threats to internal validity were evaluated first, followed by the study characteristics that may reflect meaningful differences between study results. A summary of the study characteristics can be found in Table 2.2; details for individual studies and tests are in Appendices 6.1.2 and 6.1.3, respectively.

Table 2.2. Study characteristics

		1990-1999		2000-2009		2010-2012		Total	
Studies (%)		17	(23.0)	41	(55.4)	16	(21.6)	74	(100.0)
Methodological threats to internal validity									
Study design**	Cross-sectional (%)	13	(76.5)	40	(97.6)	16	(100.0)	69	(93.2)
	Longitudinal (%)	0	(0.0)	1	(2.4)	0	(0.0)	1	(1.4)
	Unknown (%)	4	(23.5)	0	(0.0)	0	(0.0)	4	(5.4)
Sample size†	<100 subjects (%)	3	(17.7)	7	(17.1)	4	(25.0)	14	(18.9)
	100-199 (%)	9	(52.9)	15	(36.6)	1	(6.3)	25	(33.8)
	200-299 (%)	5	(29.4)	8	(19.5)	4	(25.0)	17	(23.0)
	300-1,000 (%)	0	(0.0)	5	(12.2)	3	(18.8)	8	(10.8)
	>1,000 (%)	0	(0.0)	6	(14.6)	4	(25.0)	10	(13.5)
Sampling	Convenience: students (%)	10	(58.8)	25	(61.0)	7	(43.8)	42	(56.8)
	Convenience: other (%)	2	(11.8)	4	(9.8)	5	(31.3)	11	(14.9)
	Purposive (%)	1	(5.9)	1	(2.4)	0	(0.0)	2	(2.7)
	Representative (%)	4	(23.5)	8	(19.5)	2	(12.5)	14	(18.9)
	Unknown (%)	0	(0.0)	3	(7.3)	2	(12.5)	5	(6.8)
Risk of reverse causation§	Low	0	(0.0)	1	(2.4)	0	(0.0)	1	(1.4)
	Moderate	1	(5.9)	0	(0.0)	0	(0.0)	1	(1.4)
	High	17	(100.0)	40	(97.6)	16	(100.0)	73	(98.6)
Risk of attrition§	Low	17	(100.0)	39	(95.1)	16	(100.0)	72	(97.3)
	Moderate	0	(0.0)	1	(2.4)	0	(0.0)	1	(1.4)
	High	0	(0.0)	1	(2.4)	0	(0.0)	1	(1.4)
Materialism scale§	Aspirations Index (%)	9	(52.9)	15	(36.6)	5	(31.3)	29	(39.2)
	Material Values Scale (%)	7	(41.2)	13	(31.7)	5	(31.3)	25	(33.8)
	Other validated (%)	0	(0.0)	7	(17.1)	3	(18.8)	10	(13.5)
	Other unvalidated (%)	1	(5.9)	8	(19.5)	3	(18.8)	12	(16.2)
Risk of exposure misclassification§	Low	11	(64.7)	15	(36.6)	8	(50.0)	34	(45.9)
	Moderate	7	(41.2)	19	(46.3)	5	(31.3)	31	(41.9)
	High	1	(5.9)	8	(19.5)	3	(18.8)	12	(16.2)
Risk of disease misclassification§	Low	7	(41.2)	23	(56.1)	11	(68.8)	41	(55.4)
	Moderate	12	(70.6)	21	(51.2)	6	(37.5)	39	(52.7)
	High	2	(11.8)	9	(22.0)	5	(25.0)	16	(20.3)
Studies with adjusted results (%)		7	(28.0)	11	(44.0)	7	(28.0)	25	(100.0)
Level of confounder control§	Minimal	7	(100.0)	4	(36.4)	11	(44.0)	11	(44.0)
	Moderate	0	(0.0)	5	(45.5)	4	(57.1)	9	(36.0)
	Comprehensive	0	(0.0)	2	(18.2)	3	(42.9)	5	(20.0)
Substantive moderators of effect									
Region***	North America (%)	16	(94.1)	15	(36.6)	4	(25.0)	35	(47.3)
	Europe (%)	0	(0.0)	19	(46.3)	11	(68.8)	30	(40.5)
	Australasia /Asia (%)	1	(5.9)	7	(17.1)	1	(6.3)	9	(12.2)
Mean % female (SD)		50.4	(26.4)	58.0	(11.3)	61.2	(11.7)	57.1	(16.0)
Mean age under 30 (%)		10	(58.8)	25	(61.0)	7	(43.8)	42	(56.8)
Materialism type§	Relative measure (%)	2	(11.8)	12	(29.3)	1	(6.3)	15	(20.3)
	Importance of extrinsic goals (%)	4	(23.5)	4	(9.8)	6	(37.5)	14	(18.9)
	Importance of financial success (%)	6	(35.3)	10	(24.4)	1	(6.3)	17	(23.0)
	Importance of fame/image (%)	0	(0.0)	2	(4.9)	1	(6.3)	3	(4.1)
	Material possessions (%)	7	(41.2)	13	(31.7)	5	(31.3)	25	(33.8)
	Importance of power (%)	1	(5.9)	6	(14.6)	3	(18.8)	10	(13.5)
	Other (%)	1	(5.9)	1	(2.4)	1	(6.3)	3	(4.1)

Table 2.2. Study characteristics (continued)

		1990-1999		2000-2009		2010-2012		Total	
Outcome[§]	Life satisfaction	8	(47.1)	24	(58.5)	10	(62.5)	42	(56.8)
	Affect	1	(5.9)	13	(31.7)	8	(50.0)	22	(29.7)
	Self-actualization	9	(52.9)	7	(17.1)	0	0.0	16	(21.6)
	Anxiety	4	(23.5)	9	(22.0)	1	(6.3)	14	(18.9)
	Depression	6	(35.3)	6	(14.6)	1	(6.3)	13	(17.6)
	Vitality	5	(29.4)	6	(14.6)	1	(6.3)	12	(16.2)
	Physical symptoms	3	(17.6)	7	(17.1)	0	0.0	10	(13.5)
	Summary measure	0	(0.0)	7	(17.1)	6	(37.5)	13	(17.6)
	Other	3	(17.6)	13	(31.7)	0	0.0	16	(21.6)
Outcome variable direction[§]	Good health (%)	17	(100.0)	40	(97.6)	16	(100.0)	73	(98.6)
	Poor health (%)	5	(29.4)	17	(41.5)	3	(18.8)	25	(33.8)

[†] p<0.10, * p<0.05, ** p<0.01, ***p<0.001. [§] Studies conducting multiple tests may be counted more than once; no statistical tests were used for these variables. % are column percentages.

Methodological threats to internal validity

Results from 17 studies (from 10 publications) were published in 1990-1999, 41 studies (27 publications) in 2000-2009, and 16 studies (11 publications) in 2010-2012 (no publications from 2013 met the review criteria, see Table 2.2). The majority of studies used a cross-sectional design; several additional studies did not clearly describe the design, but are most likely cross-sectional. Only one study was longitudinal. Sample sizes ranged from 40 subjects to well over 10,000 with half using fewer than 200 subjects. Nearly three quarters of the studies (72%) used convenience samples; more than half used university or college students as respondents. Fewer studies used representative samples of either local or national populations (19%); two studies used purposive samples selected for their relevance to the specific research questions (entrepreneurs and prisoners). The remaining studies gave little to no information on the source of the sample and are likely convenience samples.

Most of the studies were at risk of similar sources of bias. Reverse causation was a serious threat in 99% of the studies due to their cross-sectional design and instruments measuring current exposure (i.e. materialistic values at the time of the interview) and outcomes occurring within the past week or month; however, one study used 14-day diaries to record current emotions and physical symptoms to potentially alleviate some bias.[18] Those same studies had very low risk of attrition as well.

As expected, two measures of materialism dominated the literature: 39% of studies used some form of the Aspirations Index[18] (α=0.67-0.94) and 34% used the Material Values Scale[38] (α=0.52-0.87).

Validated values scales (Schwartz Values Scale[78] or the Portrait Values Questionnaire;[79] α=0.66-0.70, 2 studies reporting) were used in 14% studies, and 16% used some other measure, often a single question on the importance of financial success or being rich. The reliability of the Aspirations Index was reported in 29 studies and generally good; 91% of studies reported α>0.70 for all items, the extrinsic goal items, or the financial success items. The Material Values Scale was slightly less reliable across studies with 75% reporting α>0.70. The reliability of the remaining scales ranged from 0.61-0.78; 44% of these studies did not report scale reliabilities and 26% used 1-item scales.

Overall, 46% of studies used a materialism measure that was both validated in the literature and reliable in the study sample (low risk); 42% used measures that were either validated or reliable, but not both (moderate risk), and 16% used measures that were neither validated nor reliable. Because unreported reliability in a study sample was treated as α<0.70, many potentially low-risk instruments were categorized at higher risk. When limited to studies using measures with reported reliability, 62%, 29%, and 13% were at low, moderate, and high (neither validated nor reliable) risk of exposure misclassification, respectively. It should be noted that some studies were counted more than once due to their use of multiple exposure (or outcome) measures with differing levels of risk for misclassification.

Thirty-four different outcome scales or combinations of scales were used in the studies. With the exception of self-actualization scale (α=0.43-0.66), the most common outcome scales showed good reliability (α>0.70). The low reliability of the self-actualization scale (Index of Self-Actualization[80]) was concerning as few of the studies reported reliability (though this was common across measures) and, of those that did, the reliability was relatively low (α=0.43-0.66). Self-actualization, or maximizing one's full potential, is considered by some psychologists to lead to the highest levels of psychological well-being[44] and it is an important part of the theory on which much of the materialism research is based (Self-Determination Theory[81]). The reliability of positive affect measures was below 0.70 (α=0.59-0.63) in two studies; however, the reliability of the remaining affect measures was good. Only one study using a summary outcome score reported the reliability of the final measure (α=0.88); however, the other studies reported reliabilities for the individual scales, all of which were good (α=0.70-0.96).

Like the rated risk of exposure misclassification, the risk of outcome misclassification took into account the reliability and validity of the scales. Most studies used outcome measures that were low or

moderate risk but one fifth of studies used at least one measure that was considered high risk for measurement error. When limited to studies reporting reliability (not shown), 72%, 34%, and 20% of studies used an outcome measure that was low, moderate, and high risk, respectively.

Control for potential confounders was limited; 74% of studies did not adjust for any factor. Of the studies that conducted adjusted analyses, nearly half controlled only for scoring tendency or the inclination to score the importance all values or goals high or low, regardless of content. At least one demographic or socioeconomic variable was adjusted for in 36% of the studies and 20% of studies adjusted for demographic and socioeconomic factors.

The risk of selection bias affecting internal validity was generally low as all respondents, regardless of exposure or outcome status, were selected from the same source population in the same manner. However, the lack of generalizability is a greater problem in the literature and in determining whether materialism should be considered a threat to health in larger, more diverse populations.

Potential effect moderators

The studies were primarily conducted in the North America (46% in the US); however, they were also conducted in multiple countries in Europe (41%), and Australasia or Asia (12%).[a] In general, there were more women participating in the studies than men (mean proportion of women=57.1%, SD=15.9, range 0-100%; 5 studies did not report gender). Just over half of the studies (57%) used young samples (under 30; students samples with no age data were assumed to be young) with mean ages ranging 19-28 years. Mean age among the older samples ranged 32-76 years though 94% were under 50.

Six distinct constructs for materialism appeared in the literature. The most common focused on the importance of material possessions, using the Material Values Scale, appearing in one third of the studies. Other constructs focused on other specific materialistic values: financial success (23%), power or superiority (14%), and fame or image (4%). Approximately one fifth of studies combined multiple materialistic (extrinsic) values into one score and another fifth created a relative measure comparing the importance of materialistic and non-materialistic values.

[a] North American countries were US and Canada. European countries included Austria, Belgium, Croatia, Denmark, Finland, Germany, Greece, Iceland, Ireland, Israel, Luxemburg, Netherlands, Norway, Portugal, Switzerland, Spain, Sweden, and United Kingdom. Australasia comprised of Australia and New Zealand. Asian countries were South Korea and Singapore.

A variety of outcomes were used across the studies. Life satisfaction was most common (used in 57% of studies), whereas physical or psychosomatic symptoms was the least common (14%). The outcomes fell into two categories: those representing good health outcomes, used in nearly all studies in at least one test, and those representing poor outcomes, used in only one third of the studies. This categorization was used to evaluate whether materialism affects good or poor outcomes differently; for example, if materialism increases negative emotions, but does not influence positive emotions.

Trends over time

There were several shifts in the study characteristics over time. In the 1990s, nearly all of the studies were conducted in North America (primarily the US); this steadily decreased in the 2000s and early 2010s ($p<0.001$). The location of the studies shifted primarily to Europe increasing from 46% to 69% of studies in the 2000s and 2010s, respectively. Sample size was marginally associated with publication date possibly due to the rise in studies using data from large national and international studies such as the European Social Survey.[55] There was little variation in the use of young respondents, or the distribution of gender, though there was a small, non-significant increase in the proportion of female respondents.

By the 2010s, fewer studies used the Aspirations Index or Material Values Scale; no single measure appears to be gaining favor in their place. The importance of power, defined as social status, prestige, and dominance over people and resources, was measured by two validated values scales[78,79] and was more common in later years; this is likely due to the increased use of pre-existing data from large representative samples. If the trend were to hold over time, it would be consistent with natural progression of the research to investigate variations in the materialism construct and its effect on (or correlation with) mental and physical health outcomes. Among outcome measures, life satisfaction, affect, and summary outcome measures (scales combining standardized scores from multiple scales) appeared to gain popularity over time. The usage of all other outcomes (self-actualization, anxiety, depression, vitality, and physical symptoms) declined, though the small numbers of studies makes it difficult to identify robust trends. While these results are suggestive, it should be noted that the 2010s include only three years of publications (2010-2012) and the overall trends by the end of the decade may differ.

2.4.3 Explaining the unadjusted study results

This section and the next (Explaining the adjusted study results) describe the associations between study and test characteristics and study results; the results can be found in Table 2.3, Table 2.4, and Table 2.5. Many of the 74 studies used multiple measures for materialism and/or assessed multiple outcomes; the studies reported 232 tests averaging 3.1 per study (range 1-15). The following results are based on individual tests. For example, if one study tested the association of the importance of financial success with self-actualization, anxiety, and depression, each of these three tests will be counted separately; however, as described above, analytic methods took into account the shared study characteristics when calculating statistical significance. Again, statistical significance is being used here as an indicator of variables that warrant further attention; it is not intended for use in estimating effects of the independent variables. Therefore, the frequencies of study and test characteristics are presented rather than regression coefficients. As with the section above, methodological biases were evaluated first followed by the potential effect modifiers.

Most studies (92%) reported unadjusted correlations, either as the only analysis conducted or one of several. After converting the unadjusted study results to Cohen's d, the 200 distinct correlation coefficients were collapsed into three categories described above: 50% of the unadjusted correlations were both in the hypothesized direction and statistically significant (hereafter referred to as the hypothesized); 43% were not statistically significant, regardless of the hypothesized direction of effect (hereafter, non-significant); and 8% were statistically significant in the opposite direction hypothesized (referred to as the unexpected). This last proportion suggests little publication bias; however, in reality, it is unknown how many studies finding null results were not published and sufficient data are not available to assess the bias quantitatively. Of the hypothesized results, 59% were hypothesized to be a negative effect (e.g. materialism was anticipated to be negatively correlated with life satisfaction) with small (d=-0.14 to -0.34, 25%), medium (d=-0.35 to -0.63, 58%), and large (d=-0.66 to -0.90, 17%) effect sizes. Among the significant effects hypothesized to be positive (e.g. materialism was hypothesized to be positively associated with anxiety) the correlations were similarly distributed: 17% small (d=0.24 to 0.32), 63% medium (d=0.35 to 0.58), and 20% large (d=0.68 to 1.35). None of the correlations were adjusted for potentially confounding factors.

Table 2.3. Unadjusted and adjusted results from reviewed studies by methodological threats

		Unadjusted study results				Adjusted study results		
		n	Hypothesized	Non-significant	Unexpected	n	Hypothesized	Non-significant
Hypothesis tests (%)		200	50.0	42.5	7.5	58	62.1	37.9
Year of publication	*1990-1999 (%)*	47	46.8	36.2	17.0	27	59.3	40.7
	2000-2009 (%)	124	57.3	38.7	4.0	19	73.7	26.3
	2010-2012 (%)	29	24.1	69.0	6.9	12	50.0	50.0
Study design	*Cross-sectional (%)*	181	51.9	40.3	7.7	58	62.1	37.9
	Longitudinal (%)	15	40.0	53.3	6.7	0	0.0	0.0
	Unknown (%)	4	0.0	100.0	0.0	0	0.0	0.0
Sample size	*<100 subjects (%)*	**69**	**43.5**	**42.0**	**14.5**	**9**	**22.2**	**77.8**
	100-199 (%)	**84**	**51.2†**	**47.6**	**1.2**	**27**	**74.1***	**25.9**
	200-299 (%)	**19**	**42.1**	**47.4**	**10.5**	**12**	**58.3**	**41.7**
	300-1,000 (%)	**14**	**71.4***	**28.6**	**0.0**	**10**	**70.0***	**30.0**
	>1,000 (%)	**14**	**64.3**	**21.4**	**14.3**	**0**	**0.0**	**0.0**
Sampling	*Convenience: students (%)*	148	49.3	43.2	7.4	**35**	**71.4**	**28.6**
	Convenience: other (%)	14	35.7	50.0	14.3	**9**	**44.4**	**55.6**
	Purposive (%)	1	100.0	0.0	0.0	**6**	**16.7***	**83.3**
	Representative (%)	23	60.9	30.4	8.7	**8**	**75.0**	**25.0**
Risk of reverse causation	*Low (%)*	**15**	**40.0**	**53.3**	**6.7**	0	0.0	0.0
	Moderate (%)	**3**	**33.3**	**66.7**	**0.0**	0	0.0	0.0
	High (%)	**182**	**51.1†**	**41.2**	**7.7**	58	62.1	37.9
Risk of attrition	*Low (%)*	180	49.4	42.8	7.8	58	62.1	37.9
	Moderate (%)	5	100.0	0.0	0.0	0	0.0	0.0
	High (%)	15	40.0	53.3	6.7	0	0.0	0.0
Materialism scale	*Aspirations Index (%)*	111	46.9	45.1	8.1	46	63.0	37.0
	Material Values Scale (%)	47	61.7	38.3	0.0	7	71.4	28.6
	Other validated scales (%)	29	41.4	51.7	6.9	0	0.0	0.0
	Other unvalidated scales (%)	13	53.9	15.4	30.8	5	40.0	60.0
Risk of exposure misclassification	*Low (%)*	**88**	**54.6**	**35.2**	**10.2**	41	63.4	36.6
	Moderate (%)	**99**	**45.5†**	**52.5**	**2.0**	12	66.7	33.3
	High (%)	**13**	**53.9**	**15.4**	**30.8**	5	40.0	60.0
Risk of disease misclassification	*Low (%)*	79	45.6	50.6	3.8	20	65.0	35.0
	Moderate (%)	101	51.5	38.6	9.9	34	64.7	35.3
	High (%)	20	60.0	30.0	10.0	4	25.0	75.0
Level of confounder control	*Minimal (%)*					37	59.5	40.5
	Moderate (%)					14	64.3	35.7
	Comprehensive (%)					7	71.4	28.6

† p<0.10, * p<0.05. Bold results are marginally significant (p<0.10). "Hypothesized" results are statistically significant and in the hypothesized direction; "unexpected" results are statistically significant, but in the opposite direction hypothesized. No adjusted results were "unexpected." % are row percentages.

Methodological threats to internal validity

The categorized correlations were compared across study and test characteristics: first by methodological threats then by potential effect modifiers. Of the methodological threats, sample size, risk of reverse causation, and risk of exposure misclassification were at least marginally associated with the study results (see Table 2.3). A greater proportion of the tests with larger sample sizes found significant results in the hypothesized direction providing additional evidence against publication bias. High risk of reverse causation was associated with more results in the hypothesized direction when compared with low risk. Finally, a moderate risk of misclassification of materialism was associated with fewer hypothesized results compared with low risk; high risk was not significantly different from low risk. The decade of publication, study design, sample type, materialism scale, and risks of attrition or disease misclassification were not associated with study results.

Potential effect modifiers

When considering potential effect modifiers (Table 2.4), two variables warranted further attention: study location and materialism construct. Tests conducted in Europe were marginally less likely to produce significant results than tests from North America (primarily the USA). The relative materialism constructs (measures taking both materialistic and non-materialistic values into account) were the most likely to produce hypothesized results; this association was only significant, however, when compared with the importance of financial success and power constructs. The gender distribution and mean age of study samples, and outcome constructs were not associated with unadjusted study findings.

Most influential factors

In order to identify the study and test characteristics that had the strongest influence on the unadjusted study results, all characteristics marginally associated with the study results were included in two final models. As explained above, the dependent variable, study result, was collapsed into significant and in the hypothesized direction vs. not (either not significant or in the opposite direction hypothesized). The results are presented in Table 2.5. The first model included only the methodological threats: sample size, risk of reverse causation, and risk of exposure misclassification. None of the variables were associated with study results while holding the others constant and adjusting for the clustering. The second model added the potential effect modifiers: study location and materialism construct. In this

Table 2.4. Unadjusted and adjusted results from reviewed studies by potential effect modifiers

		Unadjusted study results				Adjusted study results		
		n	Hypothesized	Non-significant	Unexpected	n	Hypothesized	Non-significant
Hypothesis tests (%)		200	50.0	42.5	7.5	58	62.1	37.9
Region	*North America (%)*	**93**	**53.8**	**36.6**	**9.7**	36	63.9	36.1
	Europe (%)	**77**	**45.5†**	**46.8**	**7.8**	18	61.1	38.9
	Australasia/Asia (%)	**30**	**50.0†**	**50.0**	**0.0**	4	50.0	50.0
Mean % female (SD)		188	63.5 (13.1)	64.8 (11.0)	39.6 (40.7)	**56**	**61.0 (11.2)***	**48.7 (28.1)**
Mean age of sample	*Under 30 years (%)*	145	49.0	42.8	8.3	**36**	**72.2†**	**27.8**
	30+ years (%)	50	52.0	42.0	6.0	**22**	**45.5**	**54.6**
Materialism type	*Relative measure (%)*	**31**	**51.6**	**22.6**	**25.8**	15	66.7	33.3
	Importance of extrinsic goals (%)	**50**	**44.0**	**52.0**	**4.0**	19	52.6	47.4
	Importance of financial success (%)	**26**	**42.3***	**50.0**	**7.7**	16	62.5	37.5
	Importance of fame/image (%)	**16**	**56.3**	**37.5**	**6.3**	0	0.0	0.0
	Material possessions (%)	**47**	**61.7**	**38.3**	**0.0**	7	71.4	28.6
	Importance of power (%)	**25**	**32.0***	**60.0**	**8.0**	0	0.0	0.0
	Other (%)	**5**	**100.0**	**0.0**	**0.0**	1	100.0	0.0
Outcome	*Life satisfaction (%)*	46	43.5	43.5	13.0	**8**	**62.5**	**37.5**
	Affect (%)	38	50.0	47.4	2.6	**7**	**57.1**	**42.9**
	Self-actualization (%)	19	73.7	15.8	10.5	**10**	**90.0**	**10.0**
	Anxiety (%)	17	58.8	41.2	0.0	**6**	**16.7†**	**83.3**
	Depression (%)	16	43.8	37.5	18.8	**4**	**50.0**	**50.0**
	Vitality (%)	13	46.2	53.9	0.0	**7**	**42.9**	**57.1**
	Physical symptoms (%)	12	33.3	66.7	0.0	**5**	**80.0**	**20.0**
	Summary measure (%)	17	58.8	29.4	11.8	**5**	**40.0**	**60.0**
	Other (%)	22	45.5	50.0	4.6	**6**	**100.0**	**0.0**
Outcome type	*Good health outcome (%)*	140	47.1	42.1	10.7	38	65.8	34.2
	Poor health outcome (%)	60	56.7	43.3	0.0	20	55.0	45.0

† p<0.10, * p<0.05. Bold results are marginally significant (p<0.10). "Hypothesized" results are statistically significant (p<0.05) and in the hypothesized direction; "unexpected" results are statistically significant, but in the opposite direction hypothesized. No adjusted results were "unexpected." % are row percentages.

model, materialism construct was again associated with study results holding the other covariates constant; tests using relative materialism measures were significantly more likely to find hypothesized results than measures of the importance of financial success or the importance of power ($p<0.05$). Larger sample size was marginally associated with a greater likelihood of hypothesized test results in this model.

2.4.4 Explaining the adjusted study results

Fewer studies identified for this review reported adjusted analyses generated from regression or structural equation modeling. Similar methods as described above were used to evaluate these results using standardized beta coefficients rather than Cohen's d. Among the 38 tests with standardized coefficients, 12 (32%) hypothesized a positive effect and 26 (68%) predicted a negative effect. When limited to the significant results, 33% of the tests found a moderate effect ($|\beta|=0.35$ to 0.67) and the remaining produced small effects ($|\beta|=0.03$ to 0.34).

Methodological threats to internal validity

As before, all adjusted results were categorized into significant results in the hypothesized direction (62%) and non-significant results (38%); an additional 20 comparisons with unstandardized coefficients were included in the categorization (Table 2.3). None of the adjusted study results were unexpected, i.e. significant and in the opposite direction as hypothesized. First, the adjusted results were compared across methodological threats. Like the unadjusted study results, the adjusted results were associated with sample size; larger sample sizes were generally associated with observing a significant result. Unlike the unadjusted study results, fewer significant adjusted findings were observed when the sample was purposive compared with convenience samples of students; this could be an indication of less selective reporting or a sign that the samples, drawn from a prison population and entrepreneurs affiliated with an academic center, are quite different from the samples in other studies. There were only six tests from the purposive samples, however, and this finding should be interpreted with caution. The adjusted study results were not associated with year of publication, materialism scale used, risk of misclassification, or the level of confounder control. All adjusted associations were from cross-sectional studies; therefore, the effect of study design and risks of reverse causation or attrition could not be evaluated.

Table 2.5. Odds of statistically significant association (p<0.05) in the hypothesized direction vs. odds of association that is non-significant or in opposite direction: unadjusted and adjusted results from reviewed studies

		Unadjusted study results						Adjusted study results					
		Model 1			Model 2			Model 1			Model 2		
		OR	SE	p	OR	SE	p	OR	SE	p	OR	SE	p
Sample size	*<100 subjects*	Reference			**Reference**			Reference			Reference		
	100-199	2.10	1.22	0.20	**3.85**	**2.89**	**0.07**	3.79	5.08	0.32	12.09	23.25	0.20
	200-299	1.25	0.94	0.76	**1.22**	**1.10**	**0.83**	2.01	2.51	0.58	2.40	3.96	0.59
	300-1,000	3.69	3.81	0.21	**5.66**	**7.03**	**0.16**	3.01	4.23	0.43	20.11	39.17	0.12
	>1,000	4.53	4.45	0.12	**23.33**	**39.84**	**0.07**						
Sampling	*Convenience: students*							Reference			Reference		
	Convenience: other							0.63	0.63	0.65	3.99	6.49	0.40
	Purposive							0.18	0.27	0.25	2.71	12.83	0.83
	Representative							1.00	0.94	1.00	1.98	3.02	0.66
Risk of reverse causation	*High (vs. Low/Moderate)*	1.67	1.66	0.61	1.92	1.83	0.50						
Risk of exposure misclassification	*Low*	Reference			Reference								
	Moderate	0.55	0.29	0.25	0.62	0.56	0.59						
	High	0.51	0.49	0.48	0.67	0.86	0.76						
Region	*North America (vs. Europe/Australasia/Asia)*				2.12	2.02	0.43						
% female											1.04	0.08	0.61
Mean age under 30											4.27	5.83	0.29
Materialism type	*Relative measure*				**Reference**								
	Importance of extrinsic goals				**0.28**	**0.21**	**0.09**						
	Importance of financial success				**0.08**	**0.10**	**0.05**						
	Importance of fame/image				**0.44**	**0.57**	**0.53**						
	Material possessions				**0.38**	**0.35**	**0.29**						
	Importance of power				**0.12**	**0.13**	**0.05**						
Outcome	*Life satisfaction*										**Reference**		
	Affect										**0.25**	**0.32**	**0.28**
	Self-actualization										**4.66**	**9.24**	**0.44**
	Anxiety										**0.03**	**0.04**	**0.01**
	Depression										**0.18**	**0.28**	**0.27**
	Vitality										**0.11**	**0.13**	**0.07**
	Physical symptoms										**3.98**	**8.40**	**0.51**
	Summary measure										**0.10**	**0.15**	**0.13**

Shaded cells indicate variable not included in model. Bolded results are marginally significant (p<0.10).

Potential effect modifiers

The adjusted study results were next compared by potential effect modifiers and the associations were different than that of the unadjusted results (Table 2.4). In this case, both the proportion of female respondents and mean age of the sample were associated with study results. Tests observing significant results were more likely to come from samples with higher proportions of female respondents ($p<0.05$) and younger samples ($p<0.10$). The adjusted results were also associated with the outcome construct used; tests using anxiety as the dependent variable were marginally less likely to find a significant results than tests using life satisfaction (17% vs. 63%, $p<0.10$). As before, number of tests is small and caution should be used when considering the implications of these findings.

Most influential factors

As before, all characteristics marginally associated with the adjusted study results were included in two final models (Table 2.5). The first included only the methodological threats: decade of publication, sample size, and sample type. None of the methodological threats were associated with the adjusted study findings in this model. The potential effect modifiers, proportion female, mean age of the sample, and outcome construct, were added the model; only outcome was associated with study results. Tests using anxiety and vitality as the dependent variable were less likely to find significant results ($p<0.05$ and $p<0.10$, respectively). This suggests materialism may have a smaller impact on some outcomes (particularly anxiety and vitality) than others. It cannot be concluded that the other factors in the model do not influence the observed study results; the lack of statistical significance in this model could indicate no association or simply insufficient statistical power.

2.4.5 Study results: Physical symptoms

While a systematic review of all materialism literature has long been needed, the particular interests of this review lie in exploring whether materialism may help explain larger health trends in the US and other countries. There were 12 unadjusted correlations assessing materialism's effect on physical health symptoms. Of these, all were in the hypothesized direction: one quarter were small effects ($d=0.14$-0.26) and the rest were medium sized effects ($d=0.35$-0.54), but only four of the medium-size correlations (0.45-0.54) were statistically significant. The small number of tests made it difficult to assess any associations with study or test characteristics and no factors were significantly associated

with study results. It was noted, however, that all sample sizes were less than 200 subjects; furthermore, the studies with larger sample sizes (100-199) appeared more likely to find significant results (3 of 6 studies) than the studies with sample sizes below 100 (1 of 6). The tests with a moderate risk of materialism misclassification may have been less likely to find statistically significant results than low risk tests (2 of 9 tests vs. 2 of 3). Similarly, tests using physical symptom measures with moderate or high risk of misclassification were less likely to find significant results than those with low risk (1 of 7 vs. 3 of 5). However, given the small sample sizes, any conclusions from these data are tentative at best and these apparent trends could be entirely due to chance.

Five adjusted comparisons were conducted with physical symptoms. Of those with standardized coefficients, two were statistically significant with medium effect sizes (β=0.43-0.46) and one was not significant. Two additional comparisons reporting unstandardized results used physical symptoms as the outcome. Overall, four of the five adjusted tests of materialism's association with physical symptoms were significant and in the hypothesized direction. Because of the small number of tests, no trends could be identified; however, it was noted that all adjusted findings used minimal control for potential confounders.

2.5 Discussion

A growing body of research has investigated the effect of materialism on mental and physical health outcomes, but with the mounting evidence came the need for a synthesized overview of the literature. The purpose of this paper was to provide a systematic review of the existing literature. A relatively consistent association was found between materialistic values and worse health outcomes with 82% of unadjusted correlations and 95% of adjusted coefficients in the hypothesized direction; 50% and 62% of the unadjusted and adjusted results, respectively, achieved statistical significance. The studies and tests conducted to investigate the materialism-health relationship had many potential methodological problems, but sample size appeared to influence both unadjusted and adjusted study results. Larger sample size was associated with a higher proportion of significant results in the hypothesized direction; it remained marginally associated with unadjusted study results in the multiple regression models. This should be no surprise as statistical significance is greatly influenced by sample size and the study results were categorized by statistical significance and direction of effect. Sample size was not significant in the

multiple regression models for the adjusted study results, but this may have been due to the small number of tests (observations) included in the analysis, rather than an indication that sample size no longer mattered.

Of more theoretical interest, the specific constructs selected for both materialism and health outcome were associated with unadjusted and adjusted test results, respectively. This indicates future researchers should carefully consider both the specific aspects of materialism they are measuring and the particular outcomes that may be affected. In some cases, such as when using pre-existing data like that from the European Social Survey, there is little choice of measures, but understanding that some constructs of materialism may function differently than others is important for appropriately interpreting results. The age and gender of study respondents should also be considered in future research even though they were not significant in the multiple regression models for the adjusted study results. The lack of significance may have been due to underpowered analysis and not an indication of unimportance.

The literature investigating the effect of materialism on physical health symptoms is intriguing. While receiving relatively little interest in comparison with mental health outcomes, the study results are consistently in the hypothesized direction. Among the unadjusted study results, one-third of the tests found a significant association; however, among the adjusted results (though adjusted only minimally), four of the five tests found a statistically significant association. These results suggest materialism may affect physical symptoms, encouraging further investigation into other measures of physical health.

This review had several limitations. First, the study results were categorized according to direction of effect and $p<0.05$, perhaps overemphasizing the importance of statistical significance. It should be no surprise that sample size was associated with the study results as categorized. However, given the limitations in the details published in the literature, this approach was considered acceptable, despite the limitations. Another limitation was that many studies did not report sufficient information to accurately assess the risk of bias; assumptions, such as categorizing unreported reliability as poor, may have led to overestimation of the risk. In addition, insufficient reporting of results prevented more appropriate quantitative evaluations of the study data and results. This impacted not only the ability to use the multinomial models discussed above, but also the ability to calculate summary effect measures or evaluate the literature for publication bias. Future reviews could be improved by obtaining additional

information from authors of published studies. The small number of studies reporting adjusted results made it difficult to identify factors that may influence the observed findings; furthermore, the assessment of the physical health literature was extremely restricted. While future research should consider the factors found to be important here, factors that were not associated with study results should not be dismissed solely based on this review. Finally, this review was conducted by the author alone and no additional coauthors participated as an external quality control of the data collection or interpretation.

Overall, this review found sufficient evidence to support a preliminary detrimental association of materialism on both mental and physical health outcomes; however, caution must be taken before estimating the effect from existing literature. Future research should, at a minimum, use samples of 100 subjects or more. Researchers should also consider controlling for demographic and socioeconomic factors and testing for interaction with age in order to assess whether these variables impact the results. In addition, the materialism and health variables should be considered carefully and researchers should be aware of how different measures may affect their results. The Material Values Scale and Aspirations Index appear to be good options when investigating the effects of the importance of material possessions or materialistic goals more broadly; both measures have been used in an array of studies and have good psychometric properties. When using pre-existing data in which no measurement options exist, investigators should be aware of how their measure may affect the ability to detect an association. Fortunately, such data are likely to be rich in demographic and socioeconomic data and come from samples much larger than 100 respondents. In summary, the literature encourages epidemiological investigation into materialism's effect on mental and physical health and whether materialism should be considered a factor in the nation's health.

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Chapter 3. Materialism & physical health: Does materialism matter?

3.1 Abstract

Background: The stagnation of health in the US, despite decades of economic growth, has not been explained satisfactorily by common risk factors for health leading some researchers to call for investigations into aspects of US culture. Materialism is an often cited characteristic of US culture and has been the subject of research in psychology and consumer research, but not in epidemiology. Psychological theory suggests materialism may lead to poor mental health outcomes by blocking the fulfillment of fundamental psychological needs, and stress theory can be applied to explain why biological consequences may also result. While the existing literature supports a harmful effect of materialism on mental health, the evidence for a similar impact on physical health is limited. *Purpose:* This study aims to investigate the relationship between materialism and physical health outcomes in order to assess whether materialism should be considered as a potential risk factor for poor health in the US. *Methods:* Analyses were conducted using publically available data from a longitudinal study conducted over 30 years. Materialism was measured as the difference in the importance of financial comfort, appearance, possessions, and respect or recognition and the importance of equality, service, world peace, and living an ethical life. Physical health was assessed with two dichotomous measures: self-reported fair or poor health and reporting a chronic medical condition (heart disease or angina, stroke, high blood pressure, diabetes, obesity, or digestive problems). The total effects, mediation, and effect modification of the materialism-health association were estimated using generalized linear mixed-effects modeling with a Poisson distribution, log link function, time varying covariates, and specified with robust standard errors. *Results:* In general, materialism was not associated with either self-reported health or chronic medical conditions before or after controlling for age, gender, education, household income, negative affect, and year. In addition, there was no support for meaningful mediation or the interaction of materialism with education and household income on the additive or multiplicative scales. Sensitivity analyses found adjusting for socially desirable response patterns did not affect the null association between materialism and the health outcomes. Two variations of the materialism measure did not support meaningful associations between materialism and physical health either. However, in a sensitivity analysis among the respondents born in the 1970s and 1980s, ages 18-35 years, materialism was significantly associated

with an increase in risk of reporting poor health (RR=1.59, 95% CI: 1.25-2.01); that is, a one standard deviation increase in materialism score was associated with a 59% increase in the risk of reporting poor health. No data on chronic medical conditions were collected from this group so additional analyses were not possible. The interaction of materialism and these birth cohorts was significant on both the multiplicative and additive scales. *Discussion:* The overall results suggest materialism may not affect physical health directly in the larger US population. However, materialism may be a risk factor for poor health outcomes among younger generations of adults. Further research is needed to rule out a chance association and to determine if any effect of materialism will persist as this cohort ages.

3.2 Background

US gross domestic product (GDP) has grown from less than 1 trillion in the 1960s to over 15 trillion in 2012,[1] but, despite these economic gains, Americans are sicker and die younger than their counterparts in other high-income countries. The US now lags behind in life expectancy, cardiovascular morbidity, and other health outcomes. This trend is not limited to the poorest and most vulnerable; worse health outcomes exist among the insured, the educated, and the rich.[3] The reasons for this are unclear, though several potential explanations have garnered support including access to healthcare, health behaviors, and socioeconomic conditions. But a recent summary of this phenomenon raised the question "Could certain aspects of US lifestyle… explain why the nation is falling behind other wealthy countries across so many domains…?"[4]

Materialism, or valuing possessions and money more than relationships and self-development, is one commonly recognized aspect of US culture, yet it receives little attention from epidemiologists with few exceptions.[9,10] Materialistic messages are inescapable with media images displaying the "good life" we are supposed to want and politicians and economists encouraging consumer spending for economic growth and job creation.[34,82-84] There are indications that attitudes and behaviors related to wealth and consumption have been changing since the 1960s while the US GDP was growing and American health was stalling. For example, the proportion of American young adults that considered "being well off financially" to be very important or essential nearly doubled from 42% in 1966 to 81% in 2012.[5,6] The proportion of households with 5 or more televisions quintupled from less than 2% in 1993 to nearly 9% in 2009.[7,8] Given that social epidemiologic theories suggest social, cultural, and economic changes in society may lead to changes in disease distribution,[85] it behooves us to investigate whether the increase in materialism and stagnation in health are more than mere coincidence.

3.2.1 Prior materialism research & theory

Materialism and mental health outcomes

Despite being ignored by epidemiologists, the effect of materialism on mental health has been the center of a growing body of psychological and consumer research. Over the past several decades, studies conducted on multiple continents have found a consistent association between materialism and poor outcomes such as lower life satisfaction,[22-24] more depressive symptoms[10-15] and anxiety,[12-16] and

other forms of poor psychological well-being.[11,25-32] A recent review of the materialism literature found 65% of analyses observed significant harmful associations (Chapter 2). This association was robust across many methodological concerns, including sampling method, risk of misclassification, and level of confounder control, as well as sample characteristics, such as gender of the respondents, and geographic location of the study, after controlling for other study factors. The characteristics found to be most important in finding a harmful effect were the sample size and the materialism and outcome constructs used. While some publication bias is possible, these findings are consistent with a causal effect between materialism and mental health, and psychological theory provides an explanation for this relationship.

Materialism is defined here as a value system that assigns greater importance to obtaining material goods, money, and other extrinsically motivated indicators of status than to internally and psychologically satisfying goals. Researchers frequently cite self-determination theory[81,86] to explain why materialism may have a detrimental effect on mental or psychological health. According to the theory, materialism affects mental health by blocking the satisfaction of the universal, psychological needs for competence, control, and relatedness.[35,87-89] Humans are naturally inclined to be intrinsically motivated, seeking to explore and master activities that hold special interest and are enjoyable in their execution, and intrinsic motivation leads to the highest levels of psychological growth and well-being.[89,90] Feeling competent, or seeing oneself as capable and effective,[91] increases the likelihood of being intrinsically motivated, particularly when one feels control over the decision of which activities to pursue. The pursuit of intrinsically motivated activities is also most likely to occur in the context of strong, secure social bonds or when one has frequent, positive interactions with individuals with whom there is mutual caring and concern.[92] Therefore, the highest levels of psychological well-being may be achieved upon the fulfillment of the needs for competence, control, and relatedness; whereas poor psychological health may result when they are not satisfied.[90]

Materialism, by definition, places higher priority on extrinsic goals that generally do not satisfy these psychological needs. Common extrinsic, materialistic goals include financial success, power, and image, and are motivated by potential external rewards, e.g., to impress others, or to avoid negative consequences, such as anxiety or guilt.[40,81] As a value system, materialism is likely to guide one's

actions and attitudes suggesting that materialistic individuals will regularly choose to pursue materialistic goals over intrinsic and psychologically fulfilling activities.[93] While achieving some extrinsic goals may help satisfy the psychological needs, for example achieving financial success may give one control over when to quit an unsatisfying job or where to live, in general they are considered poor substitutes for intrinsically driven activities.[35]

Research testing the mediation of the materialism-mental health association by the psychological needs is fairly sparse. Materialism has been negatively correlated with each of the three psychological needs[11,29] and, separately, satisfaction of these needs has been correlated with better psychological and mental health outcomes.[11] However, few studies have tested mediation of the materialism-mental health association directly and inconsistencies in results using various measures[25,29-31] suggest more work is needed to better understand this mechanism.

Overall, materialistic values have been theorized to reduce mental health by 1) not satisfying psychological needs, and 2) preventing the pursuit of activities that will address those needs. However, additional evidence for this association is still needed. Furthermore, it is not clear if materialistic values have a similar effect on physical health and, if so, whether the association may function through the same mechanism.

Materialism and physical health outcomes

Given the close relationship between mental and physical health,[94] it follows that materialism could also negatively affect physical outcomes. A handful of researchers have begun to investigate the effect of materialism on physical health and, while suggestive of a harmful effect, the literature is limited. In the review discussed above, materialism had a significant, medium-sized positive association with physical health symptoms (e.g. headaches, faintness) in 8 of 17 analyses (Chapter 2). All but one of the remaining analyses found positive effects, but were not significant. While this suggests a consistent effect despite samples sizes under 200 subjects and various other methodological threats, publication bias cannot be ruled out. Furthermore, none of the analyses adjusted for demographic or socioeconomic factors allowing the possibility that the associations observed are simply due to confounding. Finally, all of the reviewed studies assessed effects on physical symptoms; none included more objective measures of physical health. Physical symptoms, such as headaches or fatigue, may be psychosomatic and closely

related to one's mental health state. There is little research testing the robustness of the association across physical health outcomes or whether the effect of materialism is restricted to mental and psychological states.

The theory behind a harmful effect of materialism on physical health is not well developed. Self-determination theory, as described above, proposes materialism may affect mental health by blocking the fulfillment of the psychological need for competence, control, and relatedness; however, this theory must be extended to explain how materialism and unfulfilled psychological needs might lead to biological consequences. Stress theory may bridge this gap if unmet psychological needs lead to stress. The theory suggests that repeated exposure to stress leads to chronic activation of biological response mechanisms causing "wear and tear" on the body and brain.[95] This process has been associated with health problems such as hypertension, diabetes, atherosclerosis, immunosuppression, and inflammation.[96,97] Should poor psychological well-being result as a consequence of unmet psychological needs, it may increase stress, or reduce one's ability to effectively cope with stress, and this greater stress may lead to biological effects. Poor psychological well-being has been associated with reduced immune function,[98,99] increased cortisol levels, and poor sleep patterns[99] supporting this potential mechanism.

The breadth of research investigating the associations of the mediators of materialism on physical health varies with each psychological need. For example, the beneficial effects of control[100-105] and the harmful effects of unmet relatedness needs, such as seen with social isolation,[102,106-108] have been well-established. The least researched is competence, but because it is considered a potential dimension of self-esteem,[91] it may be associated with better health outcomes.[109-111]

Taken together, self-determination and stress theories suggest materialism may negatively affect physical health by blocking the satisfaction of the psychological needs, reducing mental health, and increasing stress.[98,99,108,112,113] This increased stress may induce biological changes that, ultimately, affect physical health.[96] To my knowledge, no study has tested the psychological needs' mediating effects on the materialism-physical health association.

3.2.2 Effect modification

One area of the materialism research that has been largely unexplored is the potential for effect modification by socioeconomic factors. In general, working on and being successful in an activity that is highly valued is associated with greater subjective well-being.[114,115] Not comparing well with others on valued factors, however, may lead to greater distress.[114,115] By definition, materialistic individuals value money and possessions; therefore, having less money or fewer possessions than others may lead to dissatisfaction among materialistic people. Less materialistic individuals, on the other hand, may be focused on other intrinsically-driven activities, and, therefore, having less money or fewer possessions may not be as harmful to their psychological, and possibly physical, health.

Effect modification between income and materialism has been observed directly in two studies, both of which found the lowest life satisfaction among the materialistic subjects with low income.[32,116,117] Additional indirect evidence using ownership of status-enhancing or luxury goods as a proxy for materialistic values (i.e. materialistic individuals own more possessions) has offered similar findings; however, assumptions about the validity of the materialism and SES measures are necessary.[118-122] For example, one must assume whether having many expensive possessions is an indication of materialistic values, high income, or both.

Education may also interact with materialism; however, to my knowledge, no studies have tested this and the direction of the effect modification is unknown. As another common measure of SES, any potential differences in the interaction with materialism compared with that of income could be useful in understanding the mechanisms underlying any association of materialism with health.

3.2.3 Purpose

The purpose of this study was to investigate materialism as a potential contributor to the stagnation of health in the US. More specifically, it aimed to begin filling the gap in the existing literature on materialism's effect on physical health. This paper examined the potential effect of materialism on self-reported health and chronic medical conditions, after adjusting for potential confounders, in a sample of adults of all ages. Furthermore, this paper explored whether the association was mediated by the psychological needs, as suggested by theory, or modified by household income or education.

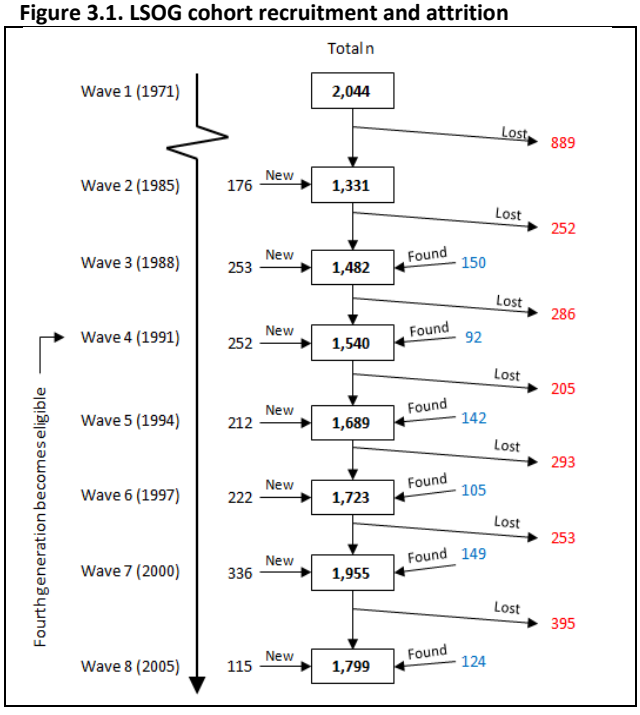
3.3 Methods

3.3.1 Sample: Longitudinal Study of Generations

A total of 2,137 respondents from the Longitudinal Study of Generations (LSOG) were included in this study. The study began in 1971 with the purpose of investigating the influence of intergenerational relationships on individual well-being, values, and attitudes. Families were recruited from a Southern California health maintenance organization (HMO) consisting primarily of economically stable, White, working- and middle-class families.[123] A random selection of male HMO members who were married at the time of recruitment, had children, and had at least one grandchild between the ages of 16 and 26 years were mailed a screening questionnaire to confirm their families' eligibility.[124,125] Members of eligible families (ages 16 years and older) were mailed baseline surveys: 516 grandparents, 701 parents, and 827 grandchildren responded (Figure 3.1). The second wave of interviews occurred 14 years later (1985), and subsequent waves occurred every three years until Wave 7 in 2000; Wave 8 was added in 2005. When feasible, interviews were self-administered using a mailed or online survey (beginning in 2000, informal communication/data workshop); telephone interviews were conducted with respondents with serious health problems to limit attrition. Spouses of family members were added to the cohort upon marriage. In 1991, the cohort began including great-grandchildren once they reached age 16.[125] As of 2005, the total cohort included 3,610 respondents from four generations. Respondents became ineligible if they were not located between waves 1 and 2, divorced a lineage member (descendant of the Wave 1 grandfathers) and had no children, became mentally incapacitated, or died.[125]

The response rates were 65% at baseline (1971) and first follow-up 14 years later (1985). Response rates for Waves 3 through 6 (1988-1997) were approximately 70-80%.[125-127] Participants were most often lost to follow up due to death or incapacitation. After controlling for

Figure 3.1. LSOG cohort recruitment and attrition



mortality-related attrition, no association was found between health or psychological well-being and loss to follow-up.[125]

In general, the analyses were limited to respondents 18 years and older who participated in or for whom data could be imputed for three consecutive interview waves (see 0 Temporality and 3.3.6 Missing data below). Several additional data limitations led to the use of subsamples in some analyses. First, the materialism scale was not administered to respondents from the oldest generation in Waves 7 or 8. In addition, questions regarding chronic medical conditions were not asked of the youngest generation respondents in any wave. Therefore, these groups of respondents were removed from specific analyses as needed.

3.3.2 Measures

Materialism

Materialism was measured as the importance or desirability of materialistic values over humanistic values (those focused on human interests) assumed to be extrinsically and intrinsically motivated, respectively. Respondents were instructed to rank items from two lists according to importance or desirability (see Appendix 6.2.1 for full scale).[125] Each list included 8 phrases and were developed by the study investigators from a modified version of the Rokeach Values Survey.[93,124] The materialism scale consisted of four materialistic and four humanistic items. The materialistic items include "financial comfort (enough to have the things you really want in life)," "respect or recognition from other people," "an attractive appearance (knowing others admire the way you look)," and "possessions (enough things so you can do what you really enjoy doing)." The remaining humanistic items include "equality (working for social justice for all)," "service (devotion to bettering mankind)," "a world at peace (working for peace on earth)," and "an ethical life (responsible living toward all)." Items were recoded so that higher ranking indicated greater importance to the respondent. The sum of the humanism item rankings was subtracted from the sum of the materialism item rankings for an overall materialism score[125,128] that range from -24 to 24; higher scores indicate the respondent is more materialistic. These scores were then standardized so that the mean equaled 0 and each unit was 1 standard deviation (z-scores). In the 1970s, at the beginning of the study, the investigators assessed the test-retest reliability in one sample of

undergraduates, estimating it as 0.78 after 4 weeks.[124] It was not possible to calculate Cronbach's alpha due to the ranked, rather than rated, nature of the items.

Health

Two measures of physical health were tested: self-reported health and chronic medical conditions. Self-reported health was assessed with "Compared to people your own age, how would you rate your overall physical health at the present time?"; responses were dichotomized (fair/poor=1, excellent/good=0) similar to other studies (e.g. Chandola 2003, Yngwe 2001).[129,130]

Chronic medical conditions "in the past few years" were self-reported by the oldest three generations. Conditions commonly associated with stress were selected, similar to a study assessing the physical effects of social comparison:[131] heart problems or angina, high blood pressure, digestion problems, diabetes, stroke (separated from the heart problems or angina category in Waves 4 through 8), and obesity (added to the conditions list in Wave 5).[b] Conditions were dichotomized to any medical condition=1 and no conditions=0.

Potential mediators

The potential mediators of the relationship between materialism and physical health, based on self-determination theory (competence, control, and relatedness), were collected at multiple waves; however, there were only three waves, 3, 4, and 8, in which all variables were collected from more than one generation. Only the mediators collected in these waves were used for the mediation analyses.

Competence was measured by three items from the Rosenberg Self-Esteem Scale.[91,132] Using a 4-point Likert scale, respondents scored their agreement with the statements "I feel that I'm a person of worth, at least on an equal plane with others," "I feel that I have a number of good qualities," and "I am able to do things as well as most other people." The summary score ranged from 0 (low competence) to 9 (high competence); this score was standardized for analysis. These items have shown good internal consistency (Cronbach's alpha=0.85) and have been validated with another competence scale.[91] The 3-item scale has been used in several studies.[133-135] However, the reliability of the scale varied widely in this sample from poor in Wave 4 (α=0.5) to good in Wave 3 (α=0.7).

[b] Excluded conditions were respiratory ailments, arthritis or rheumatism, orthopedic problem or injury, cataracts, glaucoma, or retinal degeneration, hearing impairment, severe mental or emotional distress, drinking problem, Alzheimer's disease, other serious memory problem, obesity, or other problem listed by respondent.

Locus of control measures whether respondents believe they control their situation (internal locus of control) or their situation is controlled by external forces (external locus of control). It is measured with three items study investigators selected from the Rotter locus of control scale.[136] Respondents selected the statement that "more closely [represented their] attitude at this point in life." For example, respondents were asked to choose one of the following statements: "When I make plans, I am almost certain that I can make them work" or "It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow." One point was assigned when the internal locus of control statement was chosen so that overall control scores ranged from 0-3; scores were then dichotomized (1=high control (2-3), 0=low control (0-1)) due to sparse cells. The reliability of the scale used for this analysis was moderate, ranging from α=0.5 to α=0.6.

Relatedness was measured with the quality and frequency of familial relationships. Respondents were asked about the quality of their relationships with at least one relative from each generation participating in the study. When multiple relatives met the criteria, for example, when a respondent had two sons participating in the study, the respondent focused on one relative randomly-selected by study investigators. Using 6-point Likert scales (recoded as 0=not at all to 5=extremely), respondents rated the closeness of each relationship, the quality of communication, how well the respondent and relative got along, how well the respondent understands the relative, and how well the relative understands the respondent. The item scores were summed, standardized to z-scores, and multiplied by the frequency of contact with that person. An overall score averaged the scores across family members and, finally, was categorized by quintile because it is unclear whether the score as constructed above would have a linear relationship with either materialism or health.

Though not part of the mediation hypothesized by self-determination theory, household income was considered a potential inconsistent mediator influencing the materialism-health association in the opposite direction as the psychological needs. Individuals tend to pursue activities that are highly valued;[93,137,138] therefore, it followed that materialistic people would be more motivated to pursue activities and careers that would improve the likelihood of attaining greater wealth and more possessions. Greater wealth is consistently associated with better health and the robust association has been well documented

in populations around the world across various measures of SES and health outcomes.[130,139-141] Therefore, if materialism increases income, it is likely to have a positive impact on health.

There was concern that the positive effect of income, acting as an inconsistent mediator,[142] may suppress any negative effect of materialism on physical health through the psychological needs; in other words, if materialism showed a positive association with physical health, it would have been difficult to determine whether it was because there was no negative causal effect or because the negative effect was smaller than the positive effect. Thus, household income at the time of outcome collection was controlled in order to block this pathway and isolate the potential negative effects of materialism. Household income was categorized into approximate quartiles (lowest income =1 to highest income =4). Quartiles were used because available data did not permit for precise inflation-adjustment or standardized income scores.

Potential confounders

Seven potential confounding variables were considered for these analyses: gender, age, birth cohort, household income, education level, prior psychological well-being, and pre-existing medical conditions. Gender and age have been associated with materialism in previous research; materialistic values are most often associated with younger age groups and male gender[13,25,31,128,143] with some exceptions.[13,25,30,128] Though little evidence is available, birth cohort may have influenced values through changing social norms and cultural trends.[93] For example, respondents who lived through the Great Depression may have different perceptions of the importance of financial comfort or equality than respondents who were young adults during the Civil Rights movement. Besides the obvious association through age, birth cohort may also be associated with health outcomes through differences in medical treatment and preventive care available to respondents over the life course. However, birth cohort was collinear with age in this sample, so year of the study was included to account for possible period effects. Given that variables were collected at multiple time points for each analysis (see Temporality below), the year when materialism was measured (Time t) was used.

Although, income has been hypothesized as a potential mediator of the materialism-health association, prior income may function as a confounder. Lower SES, particularly in childhood, has been associated with materialism;[10,34,35,117,144,145] materialistic values may develop as a way to compensate for

feelings of insecurity or low self-esteem, when money, possessions, and status are viewed as means to safety and security, or as giving purpose to one's life.[34,35,146,147] Household income, collected in the wave prior to materialism, was categorized into quartiles as described above.

Higher education is consistently associated with better health and, while there is little evidence, it may influence materialistic values. Respondent's prior education was categorized into less than high school (response value 1), high school graduate (2), some college or technical school (3), college graduate (4), and some graduate school and higher (5). As with household income, the education variable used to control potential confounding was collected in the wave prior to materialism.

Prior psychological and medical status were considered as potential confounders. Similar to low SES, low psychological well-being may lead to the development of materialistic values.[34,35,146-148] Furthermore, psychological well-being has been associated with physical health outcomes;[c,98,99] therefore, it was considered as a confounding variable measured by the Bradburn Affect Balance Scale.[149] Respondents were asked "During the past few weeks, did you ever feel…" for each of 10 scale items; items alternated for positive affect (e.g., "on top of the world?") and negative affect (e.g., "depressed or very unhappy?"). Positive and negative affect may be orthogonal;[150] therefore, the sum of positive item scores and negative item scores were assessed separately. Possible scores ranged from 0 (lower affect) to 5 (higher affect) and these values were converted to z-scores.

The diagnosis of a serious medical condition may also affect life values;[143,151] for example, values have been observed to change after breast cancer diagnosis[151] and the importance of materialistic values has decreased after the development of chronic physical disease.[143] Prior health status also predicts future health; therefore, pre-existing chronic medical conditions was evaluated as a potential confounder. The variable was measured as chronic medical conditions (described above) except the youngest generation of respondents, from whom no data were collected, were assumed to have no medical conditions in order to keep them in the analyses.

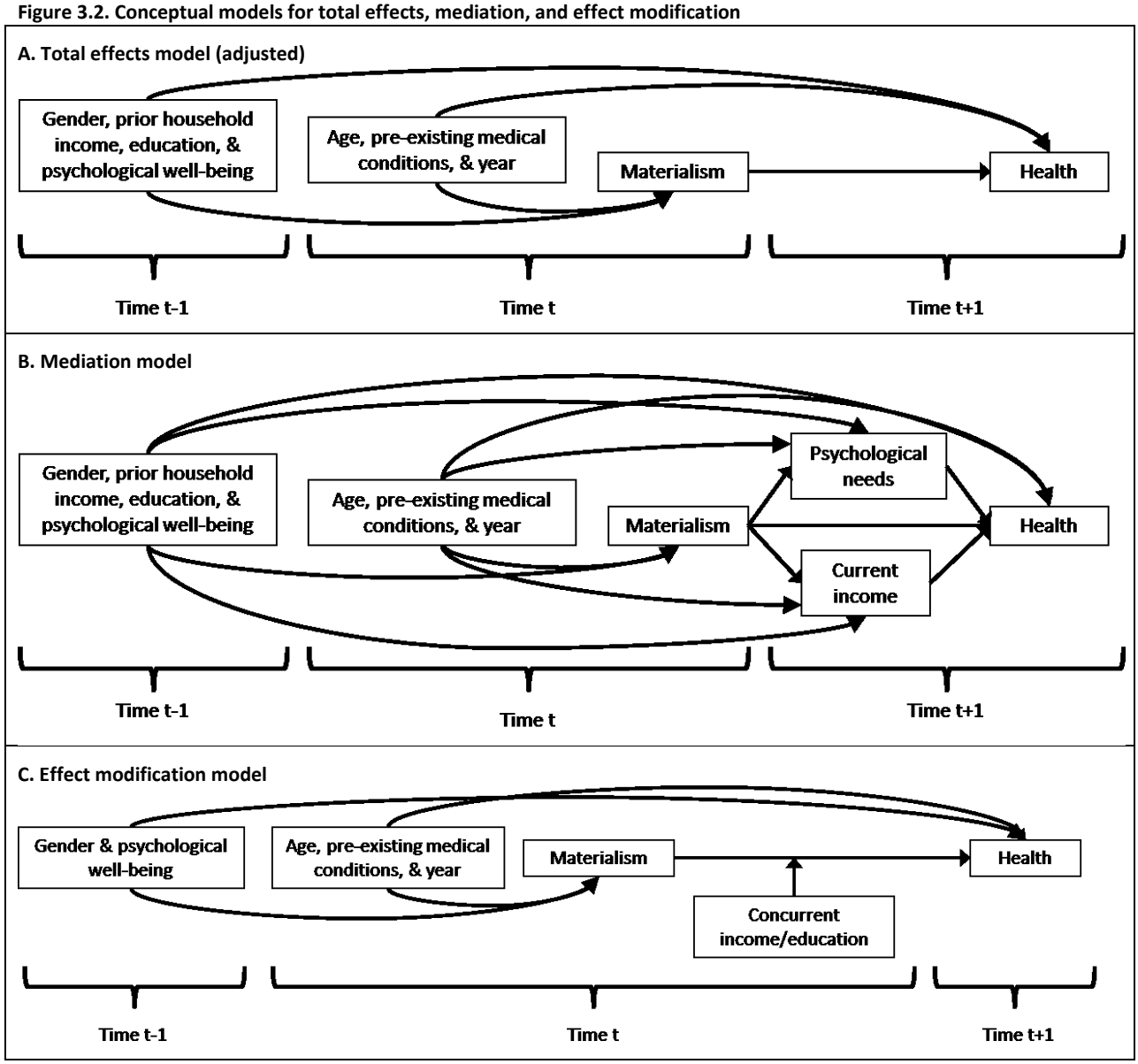
[c] Theoretically, psychological well-being could also be considered a mediator; materialism is hypothesized to reduce the fulfillment of the psychological needs which then affect emotional well-being. However, the mediation analyses in this paper were limited to the contributions of competence, control, and relatedness.

3.3.3 Temporality

One of the limitations of prior work is the questionable temporality of the independent and dependent variables. Due to the cross-sectional design of most studies, it is unclear whether materialistic values precede the poor outcomes; the possibility that the poor outcomes led to changes in materialistic values cannot be ruled out. Therefore, given the depth of the Longitudinal Study of Generations data, this study focused on examining the longitudinal associations of the independent and dependent variables.

Materialism was assessed at Time t and health at Time t+1 approximately three years later (see Figure 3.2A). Time t and Time t+1 could have been any consecutive interview waves; for example, Time t

Figure 3.2. Conceptual models for total effects, mediation, and effect modification



may have been Wave 3 with Time t+1 at Wave 4, or Time t could have been Wave 7 and Time t+1 was Wave 8.

Most potential confounders, such as prior SES (household income and education) and psychological well-being were measured at Time t-1, the wave prior to materialism's measurement. Age and pre-existing medical conditions were collected at Time t; since data on medical conditions were not collected until Wave 3, using pre-existing medical conditions at Time t, rather than Time t-1, limited the number of observations that needed to be dropped or imputed. This approach was considered sufficient to control for any confounding effects because the actual medical events occur prior to the interview ("in the past few years"), and the materialism scale measured the respondents' values at the time of the interview. For example, if a respondent was diagnosed with cancer a short time before the survey, she may have already reassessed her values or may have done so while filling out the values scale; therefore, if pre-existing medical conditions affected materialistic values, the score was likely to reflect those effects.

All mediators were measured at Time t+1 (Figure 3.2B). This includes the psychological needs variables (competence, control, and relatedness) as well as the inconsistent mediator, current income. As discussed above, the analyses only used mediators measured in Waves 3, 4 and 8, i.e. the waves in which all three variables were assessed in interviews. The temporality of the association between the mediators and outcome (both measured at t+1) is limited in this design; however, it was considered preferable to minimize the time between materialism and the outcome to approximately three years rather than extend the timeframe to six years. It was also considered more important that materialism measure preceded the mediators' measurement given that both psychological well-being and household income may lead to the development of materialistic values.

When assessing the presence of interaction, concurrent income or education were multiplied with materialism to generate an interaction term; all were measured at Time t (Figure 3.2C). Prior education and household income (at Time t-1) and current household income (the mediator measured at Time t+1) were excluded from the effect modification models as needed.

3.3.4 Statistical methods

Cross-sectional means and proportions were estimated from the 10 imputed datasets. A generalized linear mixed-effects model with a Poisson distribution, log link function, and time-varying covariates was used for nearly all analyses.[152] The models were specified with cluster-robust standard errors. This approach estimates the risk ratio (RR), rather than the odds ratio (OR), which is more appropriate given the cohort design of the study and the relatively high prevalence of the outcomes. The method also adjusts the results to account for both the clustering of individuals observed over multiple interview waves and within families. Understanding the influence of family and time on the development of materialistic values is important for evaluating the impact of materialism in the population. However, this was considered outside the scope of this study and, through these analytic methods, both are treated as nuisance variables. Readers are directed to Roberts 1999 for an analysis of developmental, cultural, and familial effects on materialistic values in the Longitudinal Study of Generations sample.[128]

Slightly different methods were used for the models testing the associations between the confounders and materialism where materialism was a continuous dependent variable, and between materialism and the mediators that were continuous or ordered categorical. These models were modified to use a normal distribution and identity link function for continuous dependent variables or a binomial distribution with multinomial logit link function for categorical dependent variables. The potential confounders and mediators must have been associated with both materialism and one of the health outcomes, $p<0.20$,[153] to be included in the total effects and mediation models.

Multiplicative interaction was assessed by adding interaction terms for each category of household income or education to adjusted models with covariates that met the potential confounder criteria described above. Additive interaction was assessed with the relative excess risk due to interaction (RERI) and the attributable proportion due to interaction (AP). The RERI, AP, and their 95% confidence intervals were calculated using the risk ratios and average covariance matrices as described by Andersson, et al.[154,155] The covariance between each pair of variables was averaged across the 10 imputed datasets; this average covariance was used to calculate the confidence intervals.

All statistical tests were conducted in Stata 12.1[156] using the *gllamm* command for generalized linear latent and mixed models, using the adaptive quadrature option, as recommended by Rabe-Hesketh and Skrondal,[157] and robust standard errors.

3.3.5 Sensitivity analyses

Several additional analyses were planned in order to better understand variation in the association of materialism and health. First, the analyses described above assume respondents answered questions accurately; however, social desirability in responses, particularly for reporting one's values, was a concern. A modified version of the Marlowe-Crowne Social Desirability scale[158] was collected at baseline. Respondents rated 7 statements as true or false, including "I always practice what I preach" and "I sometimes envy the good luck of others." Total socially desirability scores ranged from 0 (low social desirability in responses) to 7 (high social desirability). The social desirability score was added to the adjusted total effects model (Figure 3.2A) as an additional confounder. The social desirability scale was only administered at baseline; therefore, in order to avoid reducing the size of the study sample, it was restricted to a sensitivity analysis.

Two additional sensitivity analyses were conducted using variations of the materialism measure. The collective importance of the four materialistic items (the sum of the item scores) and the importance of financial comfort alone were used in unadjusted and adjusted total effects models as described above. These measures were similar to some commonly used in other studies (e.g., Kasser 1993 or 1996, Nickerson 2003).[12,13,32]

Finally, most of the existing materialism literature uses a select group of university students or young adults in the 1990s and later. This may be important as the 1970s through 1990s have been credited by some as the beginnings of modern consumer culture and rampant consumption.[84,159,160] This particular birth cohort, unlike many of the respondents in the current study's sample, would have been among the first to grow up during this time and the impact of such exposure to materialistic and consumerist messages at important developmental stages is largely unknown. Therefore, an additional analysis tested the materialism-health association among respondents of the same generation, i.e. respondents born in 1970 or later. In order to test for multiplicative interaction, an interaction term was calculated by multiplying the standardized materialism score by a dichotomous variable for cohort

membership (1=born in the 1970s or 1980s, 0=born in other decades). This interaction term and the cohort membership variable were added to the adjusted total effects model; results from this model were used to calculate the RERI and AP in order to assess additive interaction.

3.3.6 Missing data

Missing data were addressed using several techniques: carrying values forward, proxy reporting, and multiple imputation. First, in order to fill in missing values that were unlikely to change over time (or the change could be anticipated with relative confidence), data from earlier or later waves or reports by family members was used when possible. For example, children's date of birth, as reported by the mother, was used to calculate age across all waves; education was filled in according to reported education in other waves and the age of the respondent. Next, for variables that may change over time, reports by family members in the same wave were considered for filling in missing values; however, this was only done when the correlations between respondent and the relative's report was high. For example, spouse's report of household income was used to fill in respondents' missing values as correlations (among completed data) ranged from 0.89 to 0.94.

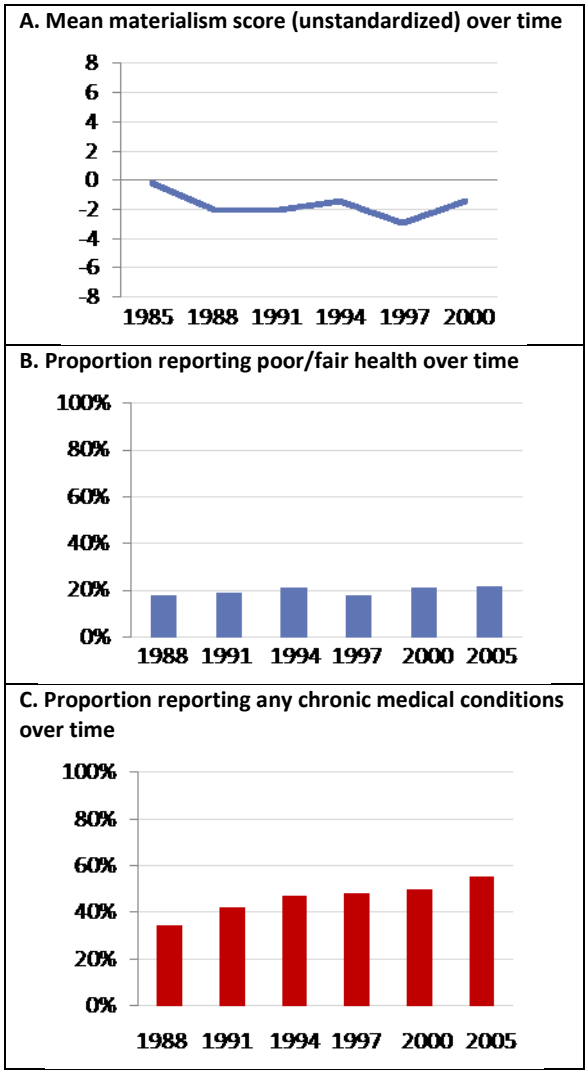
Multiple imputation by chained equations (ICE) was used to impute the remaining missing data, including waves in which respondents participated (i.e. when the respondent skipped specific questions) and those in which the respondent was known to be eligible (i.e. the respondent participated in at least one interview wave prior and one wave after). The chained equations approach can accommodate variables in multiple formats (e.g. continuous, categorical, and dichotomous variables) and does not require data to be monotone. The data were imputed in order of the amount of missing data (from variables with the fewest missing responses to those with the most); the imputed values for earlier variables in the model are used to predict values for other missing data. Given that no imputation technique has been well-established for addressing a large number of clusters and the ICC was low, no adjustments were made to accommodate clustering within families. Due to the large number of variables and amount of missing data, one large imputation model would not converge; therefore, the imputation was conducted with a series of models. These smaller imputed datasets were then merged to create one dataset for analysis. All estimates were pooled across the 10 imputations according to Rubin's rules.[161]

3.4 Results

3.4.1 Sample description

After imputation, the Longitudinal Study of Generations sample consisted of 1,400 to 1,953 respondents in each wave (see Table 3.1). As one would expect, the mean age of the cohort increased over time; once the fourth generations of respondents were added, beginning in Wave 4, the average age stabilized in the late 40s. The range in ages was large with respondents born from the mid-1880s to the 1980s. Approximately one-quarter of respondents lived through the Great Depression and another quarter were born after the Civil Rights movement, suggesting a wide range in cultural experiences that may influence one's values. Over time, the cohort became more educated despite the influx of young respondents in later waves; the proportion of respondents attending graduate school doubled from 10% in 1971 to 20% in 2005. Half of respondents recruited at baseline had no college education; that proportion was diminished to less than 20% by 2005. The study investigators credit this rise in education to social and economic changes at the national level, as well as rising educational aspiration of the younger respondents, particularly among women.[125] Finally, household income increased over the course of the study. Though income was collapsed into quartiles within each wave, the mean income levels for each quartile increased. Part of this increase was due to expected rises in average pay and inflation over time, but it may also have been due to the increased educational level of the cohort as a whole.

Figure 3.3. Mean materialism score and proportions of respondents reporting poor health or any chronic medical conditions over time



Note: unstandardized materialism scores ranged -24 to 24. Time included years during which the variables were measured for analyses. The fourth generation of respondents was not asked about medical conditions.

Overall, the mean materialism score (unstandardized) was -1.7 (SE=0.1) in the sample meaning respondents ranked humanistic values (equality, world peace, service, living an ethical life) as slightly more important than materialistic values (financial comfort, possessions, appearance, respect or recognition). The mean materialism score did not vary much over time (Figure 3.3A). Approximately 20% of the respondents reported poor health in comparison with people of the same age and, like materialism scores, this proportion did not vary much over time (Figure 3.3B). The proportion of respondents who reported at least one of the chronic medical conditions increased over time (Figure 3.3C).

3.4.2 Confounder criteria

Before running any models, the potential confounders were tested to confirm their association with the exposure and two outcome variables (see Table 3.2, column A). Materialism was associated with the demographic variables; younger respondents and men reported more materialistic values. Decade of birth was associated with materialism score with the 1940s cohort being the least materialistic; however, no clear linear pattern emerged. The year materialism was measured was also associated with materialism score and respondents reported the highest scores in 1985. However, like birth cohort, no particular pattern emerged over the years. Higher education was strongly associated with less materialistic values; household income, on the other hand, was barely associated with materialism, though it did meet the $p<0.20$ criteria. Higher prior negative affect was associated with more materialistic values; however, prior positive affect and pre-existing medical conditions were not associated.

Poor self-reported health (Table 3.2, column B) was generally associated with older age and earlier birth cohort despite the question wording “compared to people your own age.” Later interview year was generally associated with more poor health reports, but this association was not entirely linear. Men were slightly less likely to report poor health. Of the socioeconomic variables, both higher income and education were associated with better health. Higher prior positive affect score was associated with a lower likelihood of reporting poor health, whereas higher prior negative affect and pre-existing medical conditions were associated with a higher likelihood.

Nearly half of the respondents reported at least one of the chronic conditions: heart disease or angina, high blood pressure, stroke, diabetes, digestive problems, or obesity (Table 3.2, column C). As

Table 3.1. Longitudinal Study of Generations sample description

		Wave 1 (1971)	Wave 2 (1985)	Wave 3 (1988)	Wave 4 (1991)	Wave 5 (1994)	Wave 6 (1997)	Wave 7 (2000)	Wave 8 (2005)
Observed n*		1400	1292	1448	1514	1670	1696	1829	1684
Total n after imputation		1400	1537	1632	1747	1847	1880	1953	1684
		%/mean (SE)	%/mean (SE)	%/mean (SE)	%/mean (SE)	%/mean (SE)	%/mean (SE)	%/mean (SE)	%/mean (SE)
Age	*Mean age*	36.0 (0.5)	49.8 (0.4)	50.1 (0.4)	48.8 (0.4)	47.9 (0.4)	47.3 (0.4)	47.0 (0.4)	51.6 (0.47)
	<34 years (%)	44.5 (1.3)	32.5 (1.2)	17.9 (1.0)	12.8 (0.8)	19.9 (0.9)	26.3 (1.0)	31.8 (1.1)	27.4 (1.09)
	35-49 years (%)	34.5 (1.3)	12.9 (0.9)	33.6 (1.2)	45.3 (1.2)	42.6 (1.2)	36.5 (1.1)	29.3 (1.0)	8.9 (0.69)
	50-64 years (%)	14.6 (1.0)	35.5 (1.2)	29.8 (1.1)	21.7 (1.0)	13.9 (0.8)	10.7 (0.7)	13.2 (0.8)	37.7 (1.18)
	65+ years (%)	6.4 (0.7)	19.1 (1.0)	18.8 (1.0)	20.2 (1.0)	23.7 (1.0)	26.5 (1.0)	25.8 (1.0)	26.0 (1.07)
Birth Cohort	*1881-1900 (%)*	1.7 (0.4)	1.8 (0.3)	0.9 (0.2)	0.4 (0.2)	0.2 (0.1)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
	1901-1910 (%)	9.9 (0.8)	9.4 (0.8)	7.1 (0.6)	5.3 (0.5)	3.4 (0.4)	1.7 (0.3)	1.0 (0.2)	0.7 (0.21)
	1911-1920 (%)	7.9 (0.7)	7.9 (0.7)	6.3 (0.6)	5.3 (0.5)	4.5 (0.5)	3.6 (0.4)	2.6 (0.4)	2.2 (0.36)
	1921-1930 (%)	24.3 (1.2)	24.3 (1.1)	22.6 (1.0)	20.0 (1.0)	18.4 (0.9)	16.8 (0.9)	14.8 (0.8)	14.3 (0.85)
	1931-1940 (%)	12.0 (0.9)	12.0 (0.8)	11.7 (0.8)	10.7 (0.7)	9.8 (0.7)	9.3 (0.7)	8.4 (0.6)	8.9 (0.69)
	1941-1950 (%)	12.4 (0.9)	12.0 (0.8)	15.1 (0.9)	13.9 (0.8)	13.1 (0.8)	12.9 (0.8)	12.2 (0.7)	12.8 (0.81)
	1951-1960 (%)	31.9 (1.3)	32.3 (1.2)	35.8 (1.2)	33.8 (1.1)	31.2 (1.1)	29.3 (1.1)	28.0 (1.0)	27.9 (1.09)
	1961-1970 (%)	0.0 (0.0)	0.2 (0.1)	0.5 (0.2)	4.4 (0.5)	5.4 (0.5)	5.6 (0.5)	5.9 (0.5)	5.9 (0.57)
	1971-1980 (%)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	6.4 (0.6)	14.1 (0.8)	19.4 (0.9)	21.2 (0.9)	20.8 (0.99)
	1981-1990 (%)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1.5 (0.3)	5.9 (0.5)	6.6 (0.60)
Gender	*Female (%)*	57.6 (1.3)	57.4 (1.3)	57.4 (1.2)	58.6 (1.2)	59.1 (1.1)	58.3 (1.1)	57.5 (1.1)	58.0 (1.20)
	Male (%)	42.4 (1.3)	42.6 (1.3)	42.6 (1.2)	41.4 (1.2)	40.9 (1.1)	41.7 (1.1)	42.5 (1.1)	42.0 (1.2)
Education									
	< High school (%)	26.2 (1.2)	11.7 (0.9)	11.4 (0.8)	12.1 (0.9)	10.2 (0.7)	8.8 (0.7)	7.1 (0.6)	3.9 (0.5)
	High school graduate (%)	25.6 (1.2)	18.1 (1.1)	30.7 (1.2)	25.3 (1.1)	17.8 (0.9)	17.4 (0.9)	15.7 (0.9)	14.0 (0.8)
	Some college/technical (%)	33.8 (1.4)	41.7 (1.5)	26.4 (1.2)	31.5 (1.2)	41.7 (1.3)	43.2 (1.2)	44.8 (1.1)	42.6 (1.2)
	College graduate (%)	4.9 (0.6)	12.5 (0.9)	16.6 (1.0)	14.5 (0.9)	13.6 (0.8)	14.1 (0.9)	15.8 (0.9)	19.5 (1.0)
	Graduate school (%)	9.5 (0.8)	16.0 (1.0)	14.9 (0.9)	16.7 (0.9)	16.7 (0.9)	16.5 (0.9)	16.7 (0.9)	20.0 (1.0)
Household income range									
	Lowest income quartile	$3,000-$8,999	≤$19,999	≤$19,999	≤$29,999	≤$29,999	≤$29,999	≤$29,999	≤$39,999
	2nd quartile	$9,000-14,999	$20,000-29,999	$20,000-39,999	$30,000-49,999	$30,000-$49,999	$30,000-$49,999	$30,000-$59,999	$40,000-$69,999
	3rd quartile	$15,000-20,999	$30,000-39,999	$40,000-59,999	$50,000-79,999	$50,000-$79,999	$50,000-$79,999	$60,000-$89,999	$70,000-$109,999
	Highest income quartile	≥$21,000	≥$50,000	≥$60,000	≥$80,000	≥$80,000	≥$80,000	≥$90,000	≥$110,000

* Adult respondents who participated in at least two interview waves over the course of the study. Based on imputed data.

Table 3.2. Associations of confounders with materialism and outcome variables

		A. Materialism[§]				B. Poor self-reported health				C. Any chronic medical condition			
		Mean	**(SE)**	**b**	**95% CI**	**%**	**(SE)**	**RR**	**95% CI**	**%**	**(SE)**	**RR**	**95% CI**
Overall		-1.7	(0.1)			20.0	(0.5)			46.0	(0.6)		
Age	*<34 years*	-0.5	(0.3)	**Reference**		20.0	(1.1)	**Reference**		22.6	(2.2)	**Reference**	
	35-49 years	-2.6	(0.2)	**-0.26**	**(-0.33, -0.20)**	19.3	(0.8)	**0.97**	**(0.83, 1.13)**	33.8	(0.9)	**1.52**	**(1.24, 1.86)**
	50-64 years	-1.8	(0.2)	**-0.22**	**(-0.31, -0.14)**	17.6	(0.9)	**0.92**	**(0.76, 1.11)**	51.3	(1.2)	**2.31**	**(1.86, 2.87)**
	65+ years	-1.2	(0.2)	**-0.18**	**(-0.26, -0.09)**	23.4	(1.0)	**1.32**	**(1.10, 1.58)**	67.3	(1.1)	**3.08**	**(2.50, 3.80)**
Birth Cohort	*1881-1900*	1.3	(1.9)	**0.33**	**(-0.11, 0.77)**	35.0	(10.9)	**2.85**	**(1.16, 6.99)**	68.4	(11.0)	**1.87**	**(1.28, 2.73)**
	1901-1910	-0.1	(0.6)	**0.17**	**(-0.06, 0.39)**	28.2	(2.6)	**2.00**	**(1.39, 2.87)**	70.7	(2.6)	**1.83**	**(1.54, 2.19)**
	1911-1920	-1.4	(0.4)	**0.07**	**(-0.11, 0.25)**	24.6	(2.2)	**1.80**	**(1.25, 2.62)**	63.9	(2.5)	**1.70**	**(1.44, 2.01)**
	1921-1930	-1.3	(0.2)	**0.10**	**(-0.03, 0.23)**	19.4	(1.0)	**1.27**	**(0.97, 1.65)**	60.1	(1.2)	**1.56**	**(1.35, 1.81)**
	1931-1940	-1.9	(0.3)	**0.02**	**(-0.13, 0.18)**	19.0	(1.3)	**1.18**	**(0.85, 1.64)**	55.1	(1.7)	**1.41**	**(1.18, 1.69)**
	1941-1950	-2.4	(0.3)	**Reference**		16.0	(1.2)	**Reference**		38.3	(1.5)	**Reference**	
	1951-1960	-2.1	(0.2)	**0.01**	**(-0.11, 0.12)**	20.6	(0.8)	**1.31**	**(1.01, 1.71)**	31.6	(1.0)	**0.81**	**(0.69, 0.96)**
	1961-1970	-2.0	(0.6)	**0.03**	**(-0.16, 0.22)**	23.8	(2.9)	**1.46**	**(1.02, 2.08)**	31.6	(8.6)	**0.78**	**(0.37, 1.65)**
	1971-1980	-0.8	(0.4)	**0.19**	**(0.05, 0.33)**	19.1	(1.7)	**1.26**	**(0.94, 1.69)**				
	1981-1990	-0.2	(2.3)	**0.30**	**(-0.21, 0.81)**	21.7	(8.8)	**1.56**	**(0.67, 3.63)**				
Gender	*Female*	-2.3	(0.1)	**Reference**		21.1	(0.6)	**Reference**		47.3	(0.8)	**Reference**	
	Male	-0.8	(0.2)	**0.18**	**(0.12, 0.25)**	18.4	(0.7)	**0.89**	**(0.76, 1.05)**	44.2	(1.0)	**0.94**	**(0.86, 1.02)**
Education	*<12 years*	-0.2	(0.4)	**Reference**		26.1	(1.6)	**Reference**		51.0	(2.2)	**Reference**	
	High school graduate	-1.0	(0.2)	**-0.11**	**(-0.20, -0.01)**	23.3	(1.1)	**0.94**	**(0.79, 1.12)**	48.9	(1.3)	**0.97**	**(0.86, 1.10)**
	Some college/technical	-1.5	(0.2)	**-0.15**	**(-0.24, -0.06)**	19.6	(0.8)	**0.84**	**(0.71, 0.98)**	47.9	(1.0)	**0.97**	**(0.86, 1.09)**
	College graduate	-2.0	(0.2)	**-0.29**	**(-0.39, -0.18)**	15.5	(1.2)	**0.68**	**(0.54, 0.85)**	41.2	(1.7)	**0.87**	**(0.75, 1.00)**
	Graduate school	-3.2	(0.2)	**-0.27**	**(-0.38, -0.16)**	14.4	(1.0)	**0.61**	**(0.48, 0.79)**	39.6	(1.4)	**0.81**	**(0.70, 0.94)**
Prior household income	*Lowest quartile*	-1.8	(0.2)	**Reference**		26.2	(1.1)	**Reference**		53.1	(1.5)	**Reference**	
	2nd quartile	-2.3	(0.2)	**-0.04**	**(-0.11, 0.02)**	20.8	(1.0)	**0.79**	**(0.69, 0.90)**	48.6	(1.3)	**0.92**	**(0.84, 1.00)**
	3rd quartile	-1.9	(0.2)	**0.01**	**(-0.06, 0.07)**	17.4	(0.9)	**0.70**	**(0.61, 0.82)**	43.7	(1.2)	**0.83**	**(0.76, 0.92)**
	Highest quartile	-0.9	(0.2)	**-0.01**	**(-0.09, 0.07)**	14.8	(0.9)	**0.62**	**(0.52, 0.73)**	39.9	(1.3)	**0.76**	**(0.68, 0.85)**
Prior positive affect				0.00	(-0.02, 0.02)			**0.84**	**(0.81, 0.88)**			**0.93**	**(0.91, 0.96)**
Prior negative affect				**0.03**	**(0.01, 0.05)**			**1.06**	**(1.01, 1.12)**			**0.94**	**(0.91, 0.98)**
Prior chronic medical condition				-0.01	(-0.06, 0.04)			**1.93**	**(1.70, 2.20)**			**3.36**	**(3.11, 3.64)**
Year	*1985*	-0.2	(0.3)	**Reference**		17.8	(1.2)	**Reference**				**Reference**	
	1988	-2.0	(0.3)	**-0.19**	**(-0.25, -0.13)**	19.2	(1.2)	**1.08**	**(0.93, 1.26)**	34.2	(1.7)	**1.23**	**(1.10, 1.39)**
	1991	-2.0	(0.3)	**-0.21**	**(-0.27, -0.15)**	21.4	(1.1)	**1.23**	**(1.05, 1.44)**	42.1	(1.7)	**1.40**	**(1.27, 1.55)**
	1994	-1.4	(0.2)	**-0.13**	**(-0.19, -0.07)**	18.1	(1.1)	**1.07**	**(0.91, 1.25)**	46.9	(1.4)	**1.45**	**(1.32, 1.60)**
	1997	-2.9	(0.2)	**-0.29**	**(-0.35, -0.23)**	21.4	(1.1)	**1.28**	**(1.09, 1.49)**	48.3	(1.5)	**1.51**	**(1.36, 1.68)**
	2000	-1.5	(0.2)	**-0.12**	**(-0.18, -0.05)**	21.8	(1.1)	**1.35**	**(1.17, 1.57)**	49.8	(1.5)	**1.71**	**(1.55, 1.89)**

§ Mean materialism scores were unstandardized; statistical tests of the association between the confounders and materialism were based on standardized z-scores. Bold variables met p<0.20 criteria. Based on imputed data.

one might expect, the proportion of respondents who reported at least one condition increased with age and year of the study. Men were slightly less likely to report any condition. As with self-reported health, higher education and household income were associated with better health. Lower prior positive and negative affect and prior medical conditions were associated with reporting at least one medical condition.

Overall, confounders whose associations with materialism and either health outcome did not achieve p<0.20 were excluded from further analysis. Prior positive affect and pre-existing medical conditions were excluded from further analysis because neither was associated with materialism. All other variables were included in the adjusted models.

Table 3.3. Self-reported poor/fair health: total effects (unadjusted and adjusted) and mediation models

		A. Unadjusted model		B. Adjusted model		C. Mediation model	
		RR	95% CI	RR	95% CI	RR	95% CI
Materialism (standardized)		0.99	(0.93, 1.05)	0.98	(0.92, 1.05)	0.98	(0.88, 1.08)
Age	*<34 years*			**Reference**		Reference	
	35-49 years			**1.04**	**(0.87, 1.26)**	1.01	(0.80, 1.26)
	50-64 years			**1.01**	**(0.81, 1.26)**	1.04	(0.79, 1.36)
	65+ years			**1.34**	**(1.08, 1.65)**	1.18	(0.88, 1.57)
Male				1.00	(0.84, 1.20)	1.22	(1.00, 1.49)
Education	*Some high school*			**Reference**		**Reference**	
	HS graduate			**0.86**	**(0.71, 1.04)**	**0.80**	**(0.62, 1.04)**
	Some college/technical			**0.76**	**(0.63, 0.92)**	**0.70**	**(0.54, 0.91)**
	College graduate			**0.60**	**(0.46, 0.78)**	**0.57**	**(0.40, 0.81)**
	Graduate school			**0.59**	**(0.44, 0.79)**	**0.68**	**(0.45, 1.01)**
Prior Household income	*Lowest quartile*			**Reference**		Reference	
	2nd quartile			**0.82**	**(0.71, 0.95)**	0.92	(0.74, 1.15)
	3rd quartile			**0.76**	**(0.65, 0.90)**	0.93	(0.74, 1.17)
	Highest quartile			**0.70**	**(0.58, 0.85)**	0.85	(0.64, 1.13)
Negative affect				**1.10**	**(1.03, 1.17)**	**1.11**	**(1.01, 1.22)**
Year of study	*1985*			**Reference**		**Reference**	
	1988			**1.14**	**(0.97, 1.36)**	**1.14**	**(0.95, 1.37)**
	1991			**1.33**	**(1.12, 1.58)**		
	1994			**1.06**	**(0.88, 1.28)**		
	1997			**1.29**	**(1.06, 1.56)**		
	2000			**1.41**	**(1.17, 1.69)**	**1.25**	**(1.02, 1.53)**
Mediating household income	*Lowest quartile*					**Reference**	
	2nd quartile					**0.86**	**(0.69, 1.06)**
	3rd quartile					**0.78**	**(0.61, 1.00)**
	Highest quartile					**0.65**	**(0.47, 0.91)**
Competence						**0.81**	**(0.75, 0.87)**
Control						**0.81**	**(0.68, 0.97)**

Bold cells are significant (p<0.05). Shaded variables or values were not included in the model. Based on imputed data.

3.4.3 Total effects

Self-reported health

The results of the unadjusted and adjusted total effects models can be seen in Table 3.3 columns A and B. Materialism had no effect on self-reported health in either the unadjusted or adjusted models. All independent variables in the adjusted model were associated with self-reported health except materialism and gender. The oldest age group (65 years and older) was most likely to report poor health after adjusting for the other factors. Both higher prior education and household income were associated with decreasing poor health; each incremental increase in education or household income was associated with a decrease in the likelihood of reporting poor health. Year of the study was also associated with the outcome. Later years appeared to be associated with more poor health reported

Table 3.4. Any chronic medical condition: total effects (unadjusted and adjusted) and mediation models

		A. Unadjusted model		B. Adjusted model		C. Mediation model	
		RR	95% CI	RR	95% CI	RR	95% CI
Materialism		1.02	(0.98, 1.06)	1.02	(0.98, 1.06)	1.03	(0.97, 1.08)
Age	*<34 years*			**Reference**		**Reference**	
	35-49 years			**1.29**	**(1.03, 1.61)**	**1.27**	**(0.97, 1.65)**
	50-64 years			**2.13**	**(1.67, 2.71)**	**1.97**	**(1.49, 2.60)**
	65+ years			**2.58**	**(2.04, 3.27)**	**2.52**	**(1.92, 3.30)**
Male				1.00	(0.91, 1.09)	1.08	(0.97, 1.21)
Education	*Some high school*			**Reference**		Reference	
	HS graduate			**0.94**	**(0.82, 1.07)**	0.97	(0.80, 1.17)
	Some college/technical			**0.96**	**(0.84, 1.09)**	0.99	(0.83, 1.19)
	College graduate			**0.87**	**(0.74, 1.02)**	0.93	(0.73, 1.18)
	Graduate school			**0.82**	**(0.70, 0.97)**	0.89	(0.71, 1.10)
Prior Household income	*Lowest quartile*			**Reference**		Reference	
	2nd quartile			**0.97**	**(0.89, 1.07)**	0.95	(0.83, 1.10)
	3rd quartile			**0.95**	**(0.86, 1.05)**	1.00	(0.85, 1.16)
	Highest quartile			**0.87**	**(0.77, 0.98)**	0.90	(0.76, 1.08)
Negative affect				**1.08**	**(1.04, 1.13)**	**1.10**	**(1.04, 1.16)**
Year (materialism measure)	*1985*			**Reference**		**Reference**	
	1988			**1.26**	**(1.11, 1.44)**	**1.27**	**(1.10, 1.47)**
	1991			**1.44**	**(1.29, 1.61)**		
	1994			**1.45**	**(1.29, 1.63)**		
	1997			**1.46**	**(1.30, 1.65)**		
	2000			**1.58**	**(1.41, 1.78)**	**1.54**	**(1.35, 1.77)**
Mediating household income	*Lowest quartile*					**Reference**	
	2nd quartile					**0.94**	**(0.83, 1.06)**
	3rd quartile					**0.84**	**(0.72, 0.98)**
	Highest quartile					**0.85**	**(0.70, 1.02)**
Competence						0.97	(0.92, 1.02)
Control						**0.86**	**(0.77, 0.96)**

Bold cells are significant (p<0.05). Shaded variables or values were not included in the model. Based on imputed data.

except in 1994; this may have been associated with the recruitment of young respondents who may have reported better health than the older respondents.

Chronic medical conditions

As with the self-reported health analysis, materialism was not associated with reporting any chronic medical conditions in the unadjusted and adjusted models (see Table 3.4, columns A and B). In the adjusted model, older age, higher negative affect, and later study year were associated with reporting a condition. Higher prior education and household income were protective. Gender was not associated with reporting a chronic medical condition.

3.4.4 Mediation

With inconsistent mediators, the effect of materialism on health may have been suppressed explaining why no total effects were observed. In other words, materialism was hypothesized to have a harmful effect on health through the psychological needs, but a beneficial effect through improved household income. Therefore, the overall effect of materialism may have appeared to be null if the two mediated effects were equal or balanced.

Prior to running the mediation models, each of the potential mediators were tested for their association with materialism and the health outcome variables in order to confirm they met minimal criteria for mediation ($p<0.20$). Competence, control, and household income measured at Time t+1 (therefore occurring after materialism was measured and potentially affected by materialistic values) were associated with both the exposure and outcome measures. Higher materialism scores were associated with lower feelings of competence, a lower sense of control (i.e. an external locus of control), and higher household income. Higher competence, control (i.e. an internal locus of control), and household income, in turn, were associated with a lower likelihood of reporting poor health or any chronic medical conditions. Relatedness was positively associated with materialism, opposite the hypothesized direction, but not with the health outcomes; therefore, it was excluded from further analyses.

Mediation results between materialism and self-reported health are in Table 3.3, column C. Regardless of whether the mediators were added alone or together, the effect of materialism remained approximately the same. When the three mediators were included in the same mediation model, higher education, household income (measured at Time t+1), competence, and control were associated with a

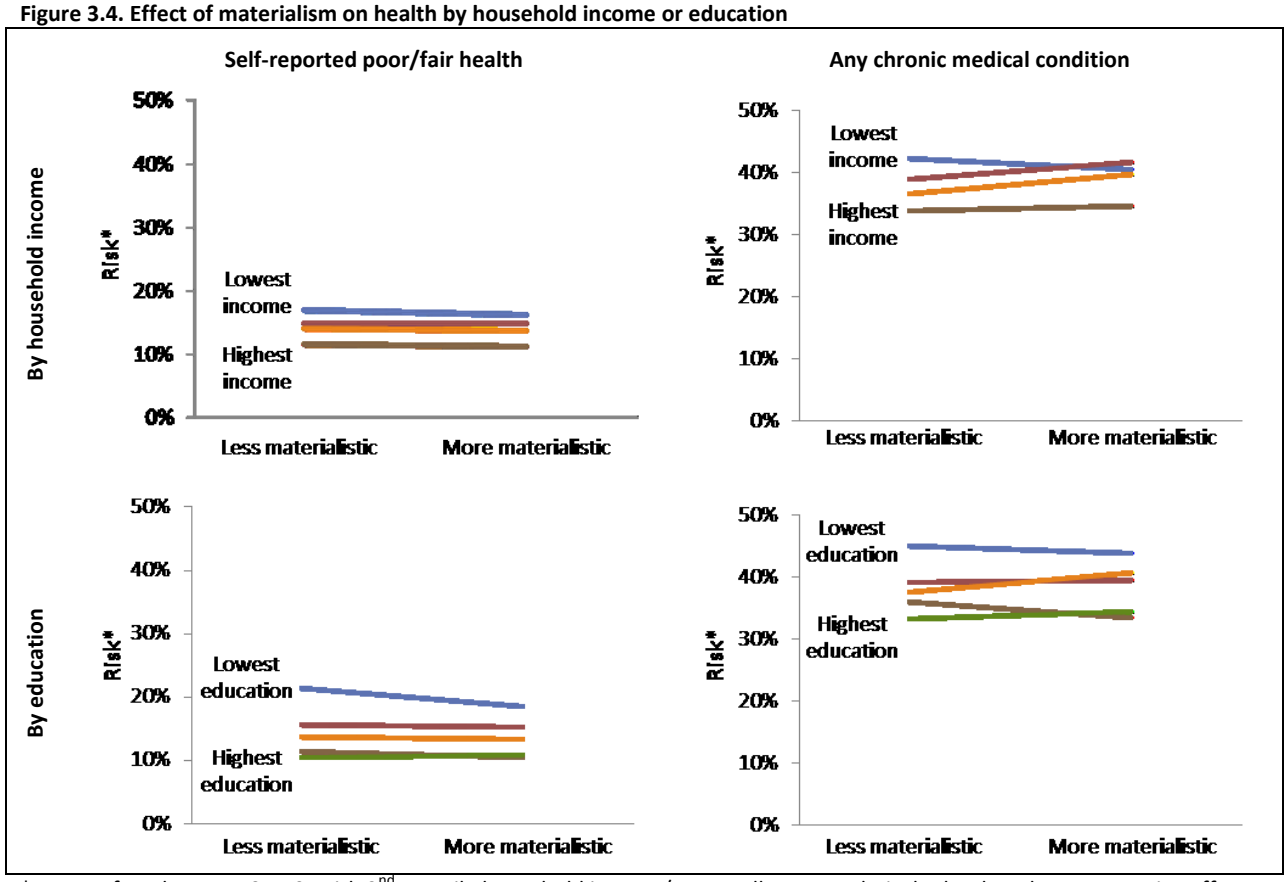
lower risk of reporting poor health. Later year in the study and higher negative affect were associated with a higher risk of reporting poor health. Men were marginally more likely to report poor health than women, after adjusting for all the variables mentioned above.

The effect of materialism on any chronic medical condition generally did not change after including the potential mediators, household income, competence, and control, alone (not shown) or together (see Table 3.4, column C). Older age, higher negative affect, and later study year were associated with reporting a chronic condition in all mediation models. Of the mediators, higher household income and control showed protective effects against reporting a chronic condition. Competence was no longer associated with the outcome after controlling for materialism, the potential confounders, and other mediators.

3.4.5 Effect modification

It was possible that materialism was positively associated with health at the lowest household income or education while negatively associated with health at the highest, or vice versa; these opposing

Figure 3.4. Effect of materialism on health by household income or education



* Among females, ages 35-49, with 2nd quartile household income/some college or technical school, and mean negative affect score in 2005. Compares standardized materialism score = -1 (less materialistic) vs. = 1 (more materialistic).

effects could have explained the null total effects. However, for both the self-reported health and chronic medical condition outcomes, neither education nor household income significantly interacted with materialism on the additive or multiplicative scales adjusting for the other covariates (Figure 3.4).

3.4.6 Sensitivity analyses

The association of materialism was tested under a variety of conditions that may have affected the observed results; unadjusted and adjusted results are in Table 3.5. First, social desirability was taken into consideration. The social desirability score was added to the adjusted total effects model among respondents who participated at baseline (when social desirability was measured). Neither materialism nor social desirability score were associated with self-reported health or chronic medical conditions after adjusting for age, gender, education, household income, negative affect, and year.

Next, two variations of the materialism measure were tested: the importance of materialistic goals alone (rather than in comparison with humanistic goals) and the importance of financial comfort. In both cases, materialism was not significantly associated with self-reported health before or after controlling for potential confounders. Both materialism measures had small, significant associations with reporting any chronic medical conditions in the unadjusted models. After controlling for the covariates, the importance of the materialistic items was no longer associated with the outcome; the effect of the importance of financial comfort was very small but remained significant.

Table 3.5. Sensitivity analyses: Effect of materialism under various conditions

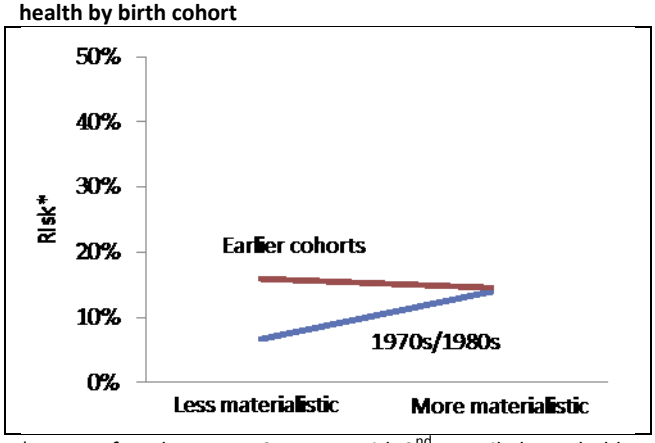
	Unadjusted model‡		Adjusted model§	
	RR	95% CI	RR	95% CI
Self-reported health				
Social desirability adjustment	0.97	(0.91, 1.03)	0.96	(0.90, 1.03)
Materialism: Importance of materialistic goals only	1.04	(0.98, 1.10)	1.02	(0.96, 1.09)
Materialism: Importance of financial comfort only	1.03	(0.97, 1.10)	1.02	(0.96, 1.09)
Materialism among 1970s & 1980s cohorts	**1.37**	**(1.10, 1.71)**	**1.59**	**(1.25, 2.01)**
Chronic medical conditions				
Social desirability	1.02	(0.97, 1.07)	1.02	(0.97, 1.06)
Materialism: Importance of materialistic goals only	**1.08**	**(1.03, 1.12)**	1.02	(0.96, 1.09)
Materialism: Importance of financial comfort only	**1.07**	**(1.03, 1.11)**	**1.04**	**(1.00, 1.08)**

‡ Unadjusted models for social desirability analyses include materialism score and social desirability score only. § Adjusted models include age (except in cohort analysis), gender, prior education, prior household income, prior negative affect, and year.
Bold cells are significant ($p<0.05$).

Finally, because of the cultural changes in attitudes and behaviors toward financial success and possessions over the past few decades and because prior research focused primarily on young adults in the 1990s and 2000s, the

association of materialism and health outcomes was evaluated among the youngest respondents, i.e. those born in the 1970s and 1980s. In the unadjusted analysis, a one standard deviation increase in the materialism score was associated with a 37% increase in the risk of reporting poor health (p<0.01). The effect increased and remained significant after controlling for age, gender, prior education, prior household income, and negative affect (RR=1.59, 95% CI: 1.25-2.01). In order to test the interaction direction, an interaction term was created by multiplying materialism and birth cohort (the 1970s and 1980s cohorts (1) vs. all prior cohorts (0)) and added to the adjusted model. This multiplicative interaction term was significantly associated with self-reported health; the interaction was significant on the additive scale as well. No data on chronic medical conditions were collected among the youngest respondents; therefore, equivalent analyses could not be conducted.

Figure 3.5. Effect of materialism on self-reported poor/fair health by birth cohort



* Among females, ages <35 years, with 2nd quartile household income, some college or technical school, and mean negative affect score in 2005. Compares standardized materialism score = -1 (less materialistic) vs. = 1 (more materialistic).

Young respondents

Upon seeing the results of the sensitivity analysis among the youngest cohorts of respondents, an ad hoc analysis was conducted to determine if respondents from earlier birth cohorts demonstrated a similar materialism-health association when they were the same age. Due to much smaller sample sizes, education and household income were collapsed (any high school (1) vs. more than high school (0), and lowest income quartile (1) vs. highest 3 quartiles (0)). Data on self-reported health were collected beginning in 1985, when members of the 1950s cohort were approximately 25-35 years of age. No significant association was found between materialism and self-reported health among the 1950s cohort at that time after controlling for gender, prior education and household income, and negative affect (RR=1.02, 95% CI: 0.76-1.36). No association was found among the 1960s cohort when they were in their late 20s to early 30s either (RR=1.10, 95% CI: 0.41-2.98). Considering the relatively late age of the 1950s and 1960s cohorts, it was unclear whether the findings were comparable to that of the youngest respondents included in the sensitivity analysis above; therefore, a refined analysis included the

respondents from the 1970s cohort reporting their health in 2005, when they were in their mid- to late 20s and early 30s. As found earlier, materialism was associated with reporting poor health after controlling for gender, prior education, household income, and negative affect (RR=1.74, 95% CI: 1.28-2.36).

3.5 Discussion

Prior research on the effects of materialism has been relatively consistent in its association with poor health outcomes; however, much of the research is focused on mental health and physical health outcomes are generally limited to symptomology. This study aimed to test an effect of materialism on additional physical health outcomes. In this study, there was little evidence to support an effect of materialism on either self-reported health or the presence of any chronic medical conditions in this sample overall. However, when limited to respondents who were similar in age and generation to subjects in other materialism studies (often referred to as Generation Xers or Millennials), materialistic values were significantly associated with higher risk of reporting poor health after controlling for age, gender, prior education, household income, and negative affect, and year. There are several potential explanations for the effect observed among the youngest respondents, but not the sample as a whole. First, this effect may have been the result of chance, particularly when considering the relatively large number of analyses conducted for this study. Because no data were collected on chronic medical conditions among the youngest respondents, the same association could not be tested with an alternative physical health outcome. The low p-value for the interaction term (p=0.002) suggests this association may not be a statistical anomaly; however, the possibility cannot be ruled out with just this study given the large number of analyses conducted.

Finding an effect among youngest generation of respondents, but not in all respondents, may have occurred due to their young age; in other words, young adults may be particularly susceptible to harmful effects on self-reported health by materialism, but as they age the effects diminish. Upon reaching ages for which chronic medical conditions become more common, materialism may not have any effect on physical health or have an effect insufficient to affect the development of more serious health problems. However, the ad hoc analysis of the 1950s and 1960s cohorts suggests young age is not a factor, at least not in other birth cohorts. Testing the association of materialism and medical

conditions among the youngest respondents would have been helpful in understanding the observed results, but, as already mentioned, there was no data to pursue this.

Finally, the association among the youngest generation of respondents may be due to factors specific to their generation, such as cultural effects during childhood and/or early adulthood. Exposure to materialistic messages either at certain developmental stages or the accumulated influence of those messages over a long period in childhood may lead to an effect that would not be observed in other birth cohorts. The findings from the sensitivity and ad hoc analyses support this. In the US, changing values among young adults from the mid-1960s to late 2000s may also indicate cohort differences across the nation. Compared with Baby Boomers (in college 1966-1978) entering college, the proportion of college-bound Generation Xers (in college 1979-1999) and Millenials (in college 2000-2009) reporting being very well off financially as very important or essential increased 59% and 67%, respectively.[162] The proportion who considered developing a meaningful philosophy in life as very important or essential dropped from 73% among Baby Boomers to 47% and 45% among Generation Xers and Milennials.[162] While these findings suggest fundamental changes in value systems across generations, more research specifically investigating differences in materialism's effect across generations is needed.

Understanding the difference between the age-related and cohort-related effects could be important. If materialism affects health among young adults, regardless of when they were born or grew up, the findings of this study suggest that, long-term, materialism will not have much impact on physical health. Both self-reported health and the presence of at least one chronic medical condition in the sample as a whole did not appear to be affected by materialism. This may mean that materialism's effect on self-reported health diminishes with age until virtually undetectable. However, if the effect of materialism is dependent on the birth cohort, then the youngest respondents in this study may suffer the consequences for a longer period of time and additional health problems may arise with age. More research is needed to confirm whether the materialism-health association is actually modified by birth cohort and the results from this sensitivity analysis are not just a chance finding in this sample.

The study had several limitations. First, the measure of materialism was unique to the Longitudinal Study of Generations and may not measure the same construct as other materialism scales. Interpretations of some of the scale items may lead to measurement error. For example, the "financial

comfort" item was intended to reflect the desire for financial success and wealth, but may have been interpreted as not living paycheck-to-paycheck by some respondents. The humanistic, or intrinsic, items did not address personal intrinsic goals, such as self-development or bonding with family and friends. While the sensitivity analyses using the importance of the materialistic items and financial comfort did not have a meaningful effect after controlling for the potential confounders, the effects of materialism on medical conditions were larger than in the main analyses and may reflect the potential for variation in materialism's effect based on the measure.

Another limitation of the measures was due to the weak reliability of several of the mediator scales, which compelled the use of caution when interpreting results from the mediation analyses. However, considering the main effect of materialism was null and the mediators did not appear to change the RR estimate, the mediator measures may not have impacted the results in this study.

Another potential limitation was the pervasive nature of materialism in the US. The potential ubiquity of materialistic values may have presented a challenge for estimating any effect of materialism; insufficient variation in the exposure may not have allowed for comparisons capable of identifying any association.[163] Prior materialism research has consistently found effects on mental health, suggesting this is not the case, but publication bias cannot be ruled out. International studies may be useful in addressing this issue as other populations may have lower prevalences of materialistic values; however, many countries share similar social and economic trends, attitudes, and characteristics and the problem may remain.

This study had several strengths as well. This investigation was among the first to assess the impact of materialism on physical health using epidemiologic methods. Prior studies have been limited to psychosomatic symptoms and often did not consider potential confounding; this study included measures for self-reported health and chronic medical conditions while adjusting for demographic, socioeconomic, and health-related covariates. Furthermore, unlike the cross-sectional studies, the temporality of the measures was better established with the use of a longitudinal cohort. Finally, this study sample was more diverse in age, education, and household income than most studies investigating materialism; results from this study may give a better picture of how materialism may affect health in the US population.

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Chapter 4. Materialism & mortality: Does materialism matter?

4.1 Abstract

Background: Despite tremendous economic growth over the past 50 years, US mortality rates are higher than that of many other high-income countries leading researchers to suggest aspects of US culture should be considered as risk factors for poor health and mortality. Materialism is an often cited aspect of US culture, but little research has investigated its effects on health. *Purpose:* This study aimed to estimate the effect of materialism on mortality and test whether the effect was modified by household income or education. *Methods:* Using publically-available data from the Longitudinal Study of Generations, 1,788 adult respondents from Southern California were followed from 1971 to 1992. Materialism was measured using selected items from the Rokeach Values Survey and calculated as the difference between the importance of materialistic goals (financial comfort, nice possessions, attractive appearance, respect or recognition) and the importance of humanistic goals (equality, service, world peace, living an ethical life). Survival was determined during study follow-up often from reports by family members. Analyses were conducted with Cox proportional hazards models specified with robust standard errors; age at study entry through death or censoring was used as the time-scale. *Results:* Materialism was not associated with mortality after controlling for age, gender, education, household income, positive and negative affect. Furthermore, materialism did not interact with household income or education. *Discussion:* Materialism did not appear to affect mortality directly in this sample. Further research on the effect of materialism on mortality may not be warranted without more evidence of an effect of materialism on physical health.

4.2 Background

The association between higher socioeconomic status and lower mortality has been well established in populations around the world and one might expect to find a similar association between the wealth of a country and the mortality rate of its population; however, this is not necessarily what is observed. The U.S. has experienced tremendous economic growth over the past 50 years with gross domestic product (GDP) growing from less than 1 trillion in the 1960s to over 15 trillion in 2012, far more than other wealthy countries.[1] But the health of Americans has not kept pace with the economic gains. Compared with 16 countries similar on economic and social characteristics in 2008, the US had the highest morality rate ranking 16th for mortality from non-communicable diseases and 14th for communicable diseases.[3] Several possible explanations have been suggested, such as access to healthcare, health behaviors, and socioeconomic conditions, but none have satisfactorily explained the phenomenon. More recently, researchers proposed the consideration of US lifestyle as a potential avenue of exploration.[4] Materialism, a well-accepted popular aspect of US culture, is one such factor.

Materialism, or valuing money and possessions more than relationships and personal growth, has been increasing in tandem with the stalling of American health. The importance of being financially successful has nearly doubled among young adults from 42% in 1966 to 81% in 2012.[5,6] In addition, household consumption of non-essential possessions has increased; for example, the proportion of US households with 5 or more televisions grew from under 2% in 1993 to nearly 9% in 2009.[7,8] These shifts in values and behavior may signal changes in society that could impact health[85] and, therefore, materialism merits consideration as a risk factor for poor health.

4.2.1 Prior materialism research & theory

Two well-supported theories, self-determination and stress theories, may help explain how materialism may affect health and longevity. First, self-determination theory[81,86] suggests that psychological well-being is greatest when one's needs for competence, autonomy, and belonging are met. In general, intrinsically motivated activities, those that are personally important and inherently satisfying, help one meet the psychological needs. However, extrinsically motivated goals and values, including materialism which is often motivated by external forces such as impressing others or avoiding shame,[35] do not generally meet the psychological needs; moreover, they tend to take time and energy

away from activities that would meet these needs and benefit mental health. While self-determination theory can explain how materialism may affect mental health, stress theory[95,96] can be used to extend the theory providing a possible mechanism through which materialism may affect physical health as well.

In general, exposure to stress generates biological responses that, in the short term, may be beneficial, but over time can lead to significant "wear and tear" on one's body. The damage caused by this process has been associated with serious health conditions including hypertension, diabetes, atherosclerosis, and coronary heart disease.[96,97,107] If poor psychological health caused by materialism leads to increased stress, the stress may have biological consequences that affect physical health and, ultimately, mortality. Taken together, self-determination and stress theory provide the rationale for an association of materialism and mortality.

Materialism has already attracted attention from psychologists and consumer researchers. A fairly robust association has been found between materialism and various poor psychological and mental health outcomes, such as lower life satisfaction,[22-24] more depressive symptoms,[10-15] and more anxiety.[12-16] The research on physical health outcomes is more sparse; most studies considering physical health are limited to psychosomatic symptoms. A recent review of the materialism literature found nearly half (8 of 17) analyses on physical symptoms observed a medium-sized harmful effect. An additional eight analyses also found materialism had a harmful effect, but did not achieve statistical significance (Chapter 2). Results from studies did not appear to differ across samples size or other methodological threats; however, the small number of analyses may have prevented the identification of any trends. These results suggest there might be an association between materialism and physical health outcomes, but, with little adjustment for demographic or socioeconomic factors, the findings may simply be the result of confounding.

4.2.2 Effect modification

While self-determination and stress theories help explain the total effects of materialism, values theory[93] suggest the effect of materialism on health may vary by socioeconomic status. Working toward and achieving highly-valued goals has been associated with greater subjective well-being[114,115] but not achieving the highly-valued goals may lead to greater distress.[114,115] Materialistic individuals value money and possessions by definition. Therefore, materialistic people who earn high incomes, accumulate

possessions, or otherwise meet their goals may be more satisfied than materialistic people who have low incomes or are unable to obtain the possessions they desire. Over time, the greater distress felt by low-income, materialistic individuals may accumulate and lead to biological consequences that impact health and longevity. Conversely, individuals who are less materialistic generally value other goals more than they value money and possessions, and, therefore, having more or less money or possessions may not be as beneficial or harmful to their health.

The evidence for effect modification is quite limited as, to my knowledge, no study has directly tested the interaction of materialism and income on a physical health outcome. However, if one assumes owning luxury or status-enhancing possessions is an appropriate proxy for materialistic values, several studies have found it was associated with more psychosomatic symptoms[118] and higher blood pressure[118-121] among individuals with lower socioeconomic status. This assumption is problematic, however, because the number of possessions owned could be an indicator of one's SES, not necessarily their values. For example, retired individuals may have relatively low-income during retirement, but had high income while working; the number of possessions could reflect that higher, pre-retirement income, regardless of the individual's values. Several other studies have found the interaction of materialism and income in predicting satisfaction,[32,116,117] but whether satisfaction may affect physical health or mortality is debatable.

While the hypothesized interaction of materialism and income is relatively straightforward, the direction of interaction between materialism and education is uncertain. As another common measure of SES with similar associations with health, education may interact with materialism in the same way as income; however, education is largely ignored in the existing materialism literature (probably due to samples with very similar educational levels, e.g. undergraduate students). An unexpected negative association between materialism and education, where increasing years of education were associated with decreasing materialism score, was observed in this study (unpublished analysis). The highest materialism scores were observed among the lowest and highest household income quartiles (unpublished analysis), suggesting any interaction of materialism with education may differ from that with income.

4.2.3 Purpose

US mortality is higher than that of other high-income countries, yet traditional risk factors, such as health behaviors and access to care, do not fully explain why. This study explored whether materialism, a well-recognized characteristic of US culture, should be considered as a possible explanation. This paper aimed to test whether materialistic values affected 20-year survival among a sample of US adults and whether this effect was modified by the socioeconomic variables education and household income.

4.3 Methods

4.3.1 Sample: Longitudinal Study of Generations

The sample for this study was selected from publically-available data from the Longitudinal Study of Generations (LSOG).[36] The original longitudinal study began in 1971 and recruited families with at least three generations, including a living grandfather, randomly selected from members of a large health maintenance organization in Southern California.[124,125] Grandparents, their children, and grandchildren were recruited into the study. The sample used for this paper included adult respondents who participated in the baseline interview and whose survival was known in 1992 (n=1,788).

4.3.2 Measures

Materialism

Materialism was measured as the difference in the importance of four materialistic values and four values centered on human interests (see Table 4.1). Study investigators selected 16 items from the Rokeach Values Survey[93,124] and divided them into two lists of eight items (half of the items were not part of the materialism scale). Respondents ranked items in each list by their perceived importance or desirability (see the full scale in Appendix 6.2.1).[125] After reverse coding the rankings so higher values indicated greater importance, the sum of the humanistic items was subtracted from the sum of the materialistic items. The scores ranged from -24 for the most humanistic to 24 for the most materialistic scores; these scores were then standardized for easier interpretation.[125,128] The items of this scale were ranked, as opposed to rated; therefore, calculating a reliability measure such

Table 4.1. Materialism scale items

Materialistic Values	Humanistic Values
• financial comfort (enough to have the things you really want in life)	• equality (working for social justice for all)
• possessions (enough things so you can do what you really enjoy doing)	• service (devotion to bettering mankind)
• an attractive appearance (knowing others admire the way you look)	• a world at peace (working for peace on earth)
• respect or recognition from other people	• an ethical life (responsible living toward all)

as Cronbach's alpha would be inappropriate. However, the test-restest reliability was 0.78 after four weeks among a sample of undergraduate students in the 1970s.[124]

Mortality

Respondent mortality, as reported by family members or discovered in follow-up, was defined as death by 1992. Mortality data compiled by investigators is publically available up to 1992; attempts to obtain more recent data were unsuccessful. Missing year of death was filled in with interview data collected from respondents' family members.

Potential confounders

Five potential confounding variables were considered for these analyses: age, gender, household income, education level, and psychological well-being. Age, gender and household income have been associated with materialism and mortality. Younger age and males have often been observed as more materialistic[13,25,31,128,143] with some exceptions[13,25,30,128] and their lower and higher mortality, respectively, is well recognized. Birth cohort was also considered as a potential confounder and thought to be associated with cultural effects and potential access to medical care over the life course; however, birth cohort was too closely associated with age and had to be dropped from further analysis. Living in a low-income household has been associated with the development of materialistic values, particularly among children, [10,34,35,117,144,145] perhaps as a way to compensate when money and possessions are viewed as means to safety and security.[34,35,146,147] Insufficient data were available to calculate precise inflation-adjusted or standardized income variables. Instead, household income was categorized into quartiles (1=lowest income to 4=highest income) in order to accommodate the changing income categories across interviews.

Education is another socioeconomic variable that is consistently associated with mortality. In an unpublished analysis, higher education was found to be associated with being less materialistic; therefore, education was considered as a potential confounder for this study. Respondents were categorized as not graduating from high school (1), graduating from high school only (2), attending some college or technical school (3), graduating from college (4), or attending some graduate school (5).

Finally, positive and negative affect were considered as potential confounders. Similar to low income, poor psychological well-being may lead to the development of materialistic values[34,35,146-148] and

it is associated with physical health outcomes.[98,99] Positive and negative affect were both measured by the Bradburn Affect Balance Scale.[149] Respondents were asked if they experienced five positive and five negative emotions in the past few weeks. Scores ranged from 0 (lower affect) to 5 (higher affect), and, like materialism, these scores were standardized.

4.3.3 Statistical Methods

The total effects and interaction models were estimated using a Cox proportional hazards model specified with robust standard errors. Age at baseline through age at death or censoring (in 1992) was used as the time-scale; using age, rather than time of observation, is considered more appropriate when following a healthy sample.[164] Events were death (1) or survival (0). Unadjusted and adjusted total effects were conducted first. The adjusted model included potential confounders that met the criteria discussed below. All covariates were measured at baseline.

Univariate linear and Cox models were used to test the associations of the potential confounders with materialism and mortality, respectively. Variables associated with both variables ($p<0.20$)[153] were kept for further analysis; the other variables were excluded.

The effect modification models were identical to the adjusted model, but with the addition of an interaction terms for each household income category (e.g. materialism * 3rd quartile) or education category (materialism * college graduate). The results from these models were used to assess effect modification on the additive scale by calculating the relative excess risk due to interaction (RERI) and attributable proportion due to interaction (AP).[154,155]

Given the respondents in this sample are nested within families, the need to address clustering of effect was assessed using a method similar to that for calculating the ICC in non-survival analyses. The variance in mortality explained by families was extremely low (<1%); therefore, no adjustment for clustering was incorporated into the analyses. All statistical tests were conducted in Stata 12.1[156] using the *stcox* and *regress* commands for Cox and linear regression modeling.

4.3.4 Sensitivity Analyses

There were several concerns that could not be addressed in the main analyses: the effect of social desirability on response patterns and the impact of different materialism measures. The accuracy of reporting, particularly for values, was a concern as some subjects may modify their responses according to how they want to be perceived. Several questions from the Marlowe-Crowne Social Desirability scale[158] were collected from respondents at baseline. Seven statements were rated as true or false, such as "I always practice what I preach" and "I sometimes envy the good luck of others." The scores ranged from 0 (minimally socially desirable responses) to 7 (highly socially desirable responses) and were standardized. The social desirability score was then added to the total effects model.

Additional materialism measures were also used in analyses in order to test the robustness of the association across scales. Similar to measures used in other studies,[12,13,32] the sum of the materialistic items and the importance of financial comfort alone were tested in place of the materialism measure in the total effects models described above. Both measures were standardized.

4.3.5 Missing data

Missing data for the independent variables were addressed primarily with multiple imputation by chained equations (ICE). This approach can include multiple types of variables (e.g. continuous, categorical, and dichotomous) simultaneously, so all independent variables were included in the same imputation model. Data were imputed for both missing responses in waves in which respondents participated as well as missing variables from waves in which the respondent was eligible, but did not participate. Ten imputations, i.e. imputed datasets, were generated; all estimates were pooled across the 10 imputations using Rubin's rules.[161]

Before imputing, missing age and household income information were filled in using reports from other family members whenever possible. Reported household income by respondents and their spouses were closely correlated (r= 0.89-0.94) and used to fill in missing values, except in Wave 2 when the correlation was considered too low (r=0.65).

4.4 Results

4.4.1 Sample description

Details of the study sample can be seen in column A of Table 4.2. In 1971, at baseline, the sample was relatively young, with about one-third under 35 years of age, and essentially evenly split among men and women (52% female). The sample was well educated with about half (51%) of the respondents receiving at least some college education or technical training after high school. The quartile of respondents with the lowest household income made less than $9,000 per year; to put this into perspective, the median household income in the US in 1971 was $9,027.[165] Respondents in the highest income quartile were making twice as much with at least $21,000 per year.

Table 4.2. Sample characteristics at baseline (1971) and confounder criteria

		A. Baseline characteristics		B. Association with materialism		C. Association with mortality	
		%/mean	95% CI	b	95% CI	HR	95% CI
Age	*≤34 years (%)*	32.3	(30.2, 34.5)	**Reference**		**Reference**	
	35-49 years (%)	33.1	(30.9, 35.3)	**0.12**	**(-0.01, 0.24)**	**2.72**	**(1.59, 4.67)**
	50-64 years (%)	17.0	(15.2, 18.7)	**-0.10**	**(-0.25, 0.05)**	**11.38**	**(6.90, 18.78)**
	65+ years (%)	17.5	(15.8, 19.3)	**0.04**	**(-0.11, 0.18)**	**39.41**	**(24.39, 63.70)**
Gender	*Female (%)*	51.9	(49.6, 54.2)	**Reference**		**Reference**	
	Male (%)	48.1	(45.8, 50.4)	**0.09**	**(-0.02, 0.19)**	**2.24**	**(1.82, 2.76)**
Education	*Some high school (%)*	22.5	(20.6, 24.5)	**Reference**		**Reference**	
	High school graduate (%)	26.9	(24.8, 28.9)	**-0.03**	**(-0.18, 0.11)**	**0.29**	**(0.22, 0.37)**
	Some college/technical (%)	36.6	(34.3, 38.8)	**-0.07**	**(-0.21, 0.06)**	**0.24**	**(0.19, 0.31)**
	College graduate (%)	4.9	(3.9, 5.9)	**-0.12**	**(-0.36, 0.12)**	**0.31**	**(0.18, 0.52)**
	Graduate school (%)	9.1	(7.8, 10.5)	**-0.44**	**(-0.63, -0.25)**	**0.24**	**(0.16, 0.38)**
Household income range	*$3,000-$8,999*	30.5	(28.4, 32.7)	**Reference**		**Reference**	
	$9,000-14,999	27.4	(25.3, 29.6)	**0.10**	**(-0.03, 0.23)**	**0.53**	**(0.42, 0.68)**
	$15,000-20,999	23.4	(21.4, 25.4)	**-0.02**	**(-0.16, 0.12)**	**0.27**	**(0.20, 0.38)**
	≥$21,000	18.7	(16.8, 20.5)	**0.12**	**(-0.03, 0.28)**	**0.24**	**(0.17, 0.35)**
Positive affect§ (mean)		3.7	(3.6, 3.8)	**-0.05**	**(-0.10, 0.00)**	**0.82**	**(0.76, 0.88)**
Negative affect§ (mean)		2.0	(1.9, 2.1)	**0.04**	**(-0.01, 0.08)**	**0.70**	**(0.65, 0.75)**

§ Mean positive and negative affect were calculated with the unstandardized scores. Their associations with materialism and mortality were calculated using standardized scores. Bold variables met p<0.20 criteria.

In 1971, the average materialism score was -2.8 (95% CI: -3.2 to -2.4) suggesting the respondents considered the humanistic items of the scale to be more important than the materialistic items. Over the twenty year period, from 1971 to 1992, 385 respondents (21.5%) passed away.

Table 4.3. Proportional hazards models: total effects and effect modification

	A. Unadjusted model			B. Adjusted model			C. Interaction: Income			D. Interaction: Education		
	HR	**95% CI**		**HR**	**95% CI**		**HR**	**95% CI**		**HR**	**95% CI**	
Materialism (standardized)	1.02	(0.94,	1.12)	1.03	(0.94,	1.14)	1.04	(0.89,	1.20)	0.97	(0.82,	1.14)
Age *18-34 years*				**Reference**			**Reference**			**Reference**		
35-49 years				**2.94**	**(1.67,**	**5.16)**	**2.92**	**(1.66,**	**5.13)**	**2.88**	**(1.64,**	**5.06)**
50-64 years				**10.27**	**(6.01,**	**17.54)**	**10.21**	**(5.98,**	**17.45)**	**10.16**	**(5.94,**	**17.37)**
65+ years				**29.59**	**(17.30,**	**50.60)**	**29.77**	**(17.40,**	**50.93)**	**29.10**	**(17.00,**	**49.82)**
Male				**2.00**	**(1.61,**	**2.49)**	**1.99**	**(1.60,**	**2.48)**	**1.99**	**(1.60,**	**2.48)**
Education *Some high school*				**Reference**			**Reference**			**Reference**		
HS graduate				**0.84**	**(0.64,**	**1.12)**	**0.84**	**(0.64,**	**1.12)**	**0.85**	**(0.64,**	**1.12)**
Some college/tech				**0.72**	**(0.55,**	**0.96)**	**0.73**	**(0.55,**	**0.96)**	**0.73**	**(0.55,**	**0.97)**
College graduate				**0.58**	**(0.33,**	**1.01)**	**0.58**	**(0.33,**	**1.00)**	**0.54**	**(0.29,**	**0.99)**
Graduate school				**0.56**	**(0.34,**	**0.91)**	**0.57**	**(0.35,**	**0.94)**	**0.55**	**(0.31,**	**0.96)**
Household income *Lowest quartile*				Reference			Reference			Reference		
2nd quartile				0.91	(0.70,	1.18)	0.91	(0.69,	1.19)	0.89	(0.68,	1.17)
3rd quartile				0.85	(0.58,	1.23)	0.85	(0.58,	1.23)	0.85	(0.59,	1.24)
Highest quartile				0.73	(0.47,	1.15)	0.72	(0.46,	1.13)	0.73	(0.47,	1.15)
Positive affect				0.96	(0.87,	1.06)	0.96	(0.87,	1.06)	0.95	(0.86,	1.05)
Negative affect				0.96	(0.85,	1.09)	0.96	(0.85,	1.09)	0.95	(0.84,	1.08)
Materialism*Income												
Lowest quartile							Reference					
2nd quartile							0.97	(0.77,	1.23)			
3rd quartile							0.96	(0.72,	1.27)			
Highest quartile							0.97	(0.77,	1.23)			
Materialism*Education												
Some high school										Reference		
HS graduate										1.16	(0.90,	1.50)
Some college/technical										1.17	(0.91,	1.51)
College graduate										0.88	(0.55,	1.39)
Graduate school										1.02	(0.68,	1.54)

Bold cells are significant (p<0.05). Shaded variables or values were not included in the model.

4.4.2 Confounder criteria

Gender, education, household income, positive and negative affect were tested for their association with materialism and mortality in order to assess their eligibility as confounders (see Table 4.2, columns B and C). All of the potential confounders were associated with both materialism and mortality ($p<0.20$) and they were kept for further analysis.

4.4.3 Total effects

An unadjusted Cox model was run first with materialism alone (Table 4.3, column A); materialism was not associated with mortality (HR=1.02, 95% CI: 0.94-1.12). After adjusting for age, gender, education, household income, positive and negative affect, the hazard ratio remained close to null (Table 4.3, column B). Controlling for the other covariates, older age was strongly associated with higher mortality and men had twice the mortality rate of women (HR=2.00, 95% CI 1.61-2.49). Respondent who attended college had lower mortality compared with respondents who did not graduate from high school. Household income, positive and negative affect were not significantly associated with mortality after controlling for materialism score, age, gender, and education; this may have been due to the high proportion of young respondents in the lowest household income quartile and the relatively high income of the lowest quartile (just below the 1970s median household income).

4.4.4 Effect modification

The results from the adjusted effect modification models can be seen in columns C and D of Table 4.3. When the interaction term for materialism and education (column C) or household income (column D) was added to the model, the multiplicative interaction was not significant. Using the results from the models, the RERI and AP were calculated. Materialism did not interact with education or household income and on the additive scale either.

4.4.5 Sensitivity analyses

Three sensitivity analyses were conducted in order to address additional questions regarding the robustness of the association (or lack of association) between materialism and mortality (Table 4.4). First, social desirability was added to the model to control for potential differences in response patterns.

Adjusting for social desirability made little difference in the materialism-mortality association estimate; materialism remained unassociated with mortality. Next, two variations of the materialism measure were tested as they were similar to measures used by other researchers.[12,32] While both measures were significantly associated with mortality in the unadjusted models, neither the importance of the materialistic items (financial comfort, nice possessions, attractive appearance, and respect or recognition) nor the importance of financial comfort was associated with mortality after adjusting for age, gender, education, household income, positive and negative affect.

Table 4.4. Sensitivity analyses: Effect of materialism under various conditions

	Unadjusted model		Adjusted model[§]	
	HR	95% CI	HR	95% CI
Social desirability adjustment	1.04	(0.95, 1.14)	1.03	(0.94, 1.14)
Materialism: Importance of materialistic goals only	**1.24**	**(1.13, 1.35)**	1.07	(0.97, 1.19)
Materialism: Importance of financial comfort only	**1.20**	**(1.08, 1.33)**	1.00	(0.91, 1.11)

§ Adjusted for age, gender, education, household income, and positive and negative affect.
Bold cells are significant ($p<0.05$).

4.5 Discussion

This study is among the first to test the association between materialism and mortality in a sample of US adults of all ages. Materialism was found to have no meaningful association with mortality. Considering the mixed evidence on materialism's effect on physical health, this was not entirely surprising. While it is plausible that materialism may be able to generate sufficient stress to influence headaches, fatigue, or other symptoms, it would likely require a large amount of stress, perhaps over an extended period of time, to generate biological consequences harmful enough to affect mortality. The results from these analyses suggest materialism does not affect one's longevity directly, even after controlling for social desirability and using several different measures for materialism. At this time, further research into the association between materialism and mortality may not be justifiable until new research establishes a much stronger connection between materialistic values and physical health in general.

There were several limitations to this study. First, the scale used to measure materialism is unique to this study and may not measure the same materialism construct as other studies. Furthermore, the wording of several items, such as "financial comfort," may be misinterpreted by respondents. For example, some respondents may consider financial comfort to mean living free of financial hardship or having enough money to pay all obligations without worry; however, the question is intended to tap into

the materialistic goal of being rich. This misclassification would likely lead more respondents to be categorized as materialistic, biasing the results toward the null.

Another potential limitation is the selection of families for the study. As part of the eligibility criteria, all recruited families had to have a living grandfather; therefore, the families in this study may be healthier than families in the general population. It is possible that families with members vulnerable to materialism's effects experienced earlier mortality and were excluded from this study. However, given there is little hint of an association in these results, it seems unlikely that there would be much of an association even if more vulnerable families were included.

Finally, given the ubiquity of materialistic messages, it is possible that the values of all respondents were too homogeneous to detect any association with longevity. In other words, materialism may affect health at very low levels or scores; if most respondents have materialism scores above that threshold, it would be difficult to detect any effect. Considering prior materialism research in the US has found correlations between materialism and mental health outcomes, this may not be an issue; however, research from other populations with wider variation would be useful in ruling out this potential limitation.

Despite the limitations, this study has several strengths. The Longitudinal Study of Generations sample provided a relatively large number of adult respondents of all ages observed over a long period, Furthermore, the study provided sufficient data to control for important confounders and test for the interaction of materialism and socioeconomic factors.

Overall, this study provides evidence suggesting that materialism may not contribute to the higher mortality rates found in the US in comparison with other high-income countries. Future resources should be spent investigating other possible explanations.

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Chapter 5. Conclusions

The disconnect between US wealth and the health of its people is a puzzling phenomenon that has led some investigators to propose the consideration of cultural factors.[4] The purpose of this study was to investigate materialism, a well-recognized feature of the typical US culture that has shown promise in psychological and consumer research, but whose effect on physical health is largely unknown. Prior materialism studies have been limited by their use of physical symptoms as the primary physical health outcome, cross-sectional study designs preventing temporality from being established, and samples with limited generalizability, and little control for potential confounders. This project aimed to be among the first to estimate the effect of materialism on physical health outcomes using epidemiologic methods. This study was designed to improve on prior studies through its use of several measures of physical health (self-reported health, chronic medical conditions, and mortality) and a 35-year longitudinal study that followed respondents with a wide age range, and by adjusting for several important potential confounders including age, gender, household income, and education.

For the most part, this study found no association between materialism and physical health. In the unadjusted and adjusted analyses, materialism was not associated with self-reported health, chronic medical conditions, or mortality. The mediation analysis in Chapter 3 did little to affect the results. Despite having inconsistent mediators (materialism was hypothesized to have a negative effect on physical health by blocking the satisfaction of the psychological needs, but a positive effect by increasing income), inclusion of the mediators, separately or together, did not change the materialism association. Similarly, adding interaction terms for materialism and household income or education did not appear to alter the results. In fact, all but one series of the analyses found a null effect; the only exception was a sensitivity analysis among the respondents born in the 1970s and 1980s.

When the sample was limited to the youngest generations of respondents, materialism showed a significant association with worse self-reported health. The interaction between materialism and birth cohort was statistically significant. As discussed above, this association could have been a chance finding given the number of analyses conducted for this project. Alternatively, the association may also indicate an effect of materialism among the most recent cohorts of adults that is not experienced by older cohorts. Future investigations are needed to verify the association found here and, if one exists, these

young adults should be followed over time as the prevalence of medical problems and chronic conditions increase. Whether materialism may affect more serious medical conditions remains to be seen.

The null association found in the main sample was not entirely surprising considering there was little evidence to suggest materialism could cause more serious health problems than psychosomatic symptoms. However, it was surprising to find a relatively strong association between increasing education and decreasing materialism scores; when household income and education were included in the same model, higher education remained strongly associated with lower materialism while income was not associated. When reviewing the literature, there was little to suggest this relationship would exist, much less why education and materialism would be so strongly related. It is possible that more education somehow "teaches" individuals to be less materialistic. Alternatively, less materialistic people may be more likely to pursue higher education. Further investigation into this association would enhance the current understanding of materialism and, perhaps, clarify the potential mechanisms for its effects.

Despite trying to address limitations in other studies, this project had its own weaknesses. The measure of materialism used in the Longitudinal Study of Generations interviews was similar, but not the same as measures used in other studies. Some scale items, particularly the financial comfort item, may have been misinterpreted. In addition, while the Longitudinal Study of Generations cohort is more diverse in age than many of the existing study samples, it is relatively racially homogeneous (approximately 90% Caucasian) and is not representative of people at the extreme ends of the socioeconomic spectrum. This limits the ability of this sample to address questions aimed at estimating effects in the US population.

This dissertation did not consider many potential consequences of materialism that may indirectly affect health, including the environmental, economic, and social impacts. For example, at a national level, excessive consumption due to the desire for an ever-changing list of possessions may have environmental impacts that affect health not only in the US, but potentially in other countries around the world.[166] In addition, the financial stressors of low or even middle income individuals who spend too much and are willing to take on greater amounts of debt in order to "keep up with the Joneses" may experience stress[167] that leads to its own health consequences. Furthermore, simply the suggestion of materialistic images may lessen social bonds by increasing feelings of selfishness and competitiveness,[168] and reducing one's willingness to help others.[169]

Perhaps the most insidious potential effect of materialism is the ability to generate subconscious effects on all Americans, regardless of their personal values. As materialism has increased, the drive to earn more and buy more has become standard practice. In the 1930s, it was suggested that the rise of technology would allow Americans to cut down their work hours to 15 hours per week;[170] however, that decrease in work time never materialized. Does that mean everyone who continued to work was materialistic? Of course not, but if the least materialistic individuals decided to work only 15 hours each week they might have been risking unemployment. This acquiescence to working more hours, wanting higher salaries, etc. may have consequences to mental and physical health. An experiment among psychology students randomly assigned intrinsic or extrinsic goals and asked the students to work toward the goals for four weeks.[69] The progress toward the assigned goals and subjective well-being of the students was measured at weeks 2 and 4. Students who worked toward intrinsic goals experienced improvements in subjective well-being as they progressed toward the goals. Students who worked toward extrinsic goals experienced no change in well-being. Moreover, this effect was observed among both the materialistic students and those who were less materialistic; the values of the student did not modify the effect. This suggests that, while working toward extrinsic goals may not be harmful to psychological health, their pursuit may block the beneficial effect of working toward intrinsic goals. More importantly, this effect may hold regardless of one's values.

Perhaps the "traditional" goals of earning more money or accumulating more possessions may not be harmful per se, but if more time was spent on intrinsically-motivated activities instead, everyone may be better off. It could be that values matter to some extent, but behavior matters more. Consider the comparisons made at the beginning of this dissertation between the US and other high-income countries. When it comes to policies that give individuals time to pursue more intrinsic activities, the US ranks poorly. The US is the only country in the list that does not legally mandate 10 paid vacation days or more per year. With the exception of Japan (which gives 10 paid vacation days), the other countries guarantee 19 or more paid holidays and vacation days each year.[171] In the US, new parents are allowed 24 weeks of unpaid leave without losing their job. In all the other countries except Australia (who grants 52 weeks unpaid leave), the parents are given at least 11-47 weeks of *paid* parental leave, often with additional

unpaid leave as well. Perhaps, then, it is not the materialistic lifestyle that affects physical health, but the policies that develop from the high prevalence of materialistic values and goals.

In conclusion, although materialism has been associated with poor mental health outcomes in other studies, it was not associated with physical health outcomes in this sample as a whole. Overall, these results suggest that materialistic values do not explain the trends in US health that have occurred over the past 50 years. However, there was some evidence that materialism may affect physical health among young adults born in the 1970s and 1980s. Further research is needed to determine whether an association exists between materialism and physical health among younger adults as their health will define the nation's health in years to come.

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Chapter 6. Appendices

6.1 Appendices for the Systematic Review (Chapter 2)

6.1.1 Additional inclusion/exclusion criteria

Measures using respondent-generated lists of goals or aspirations were excluded as these measures may not capture the same construct across respondents, e.g. failure of a respondent to list money as an important goal does not necessarily mean that goal is not important for that individual as she may have simply forgotten to list it. Non-materialistic, extrinsic goals (i.e. extrinsic goals not focused on status enhancement, such as academic goals pursued because "someone else wants you to"[113]) were not considered. Studies measuring materialism as a personality traits or as political values, such as in the Belk materialism scale[172] or Inglehart's materialism-postmaterialism scale[173] were excluded. Belk's materialism scale was excluded due to evidence supporting its relationship with life satisfaction is explained by its association with neuroticism.[72]

6.1.2 Details of individual studies selected for review

Study	Study details	Sample details
Ahuvia 1995[22]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Undergraduate students - seniors - enrolled in undergraduate marketing course at Midwestern university **n:** 200 **% female:** 55 **Mean age:** UK (SD=UK), range=UK
Bobowik 2011a[47]	Country: Spain **Study design:** Cross-sectional Sampling: Unknown	**Sample description:** Adults from general population in Basque country, Spain **n:** 1,361 **% female:** 58 **Mean age:** 39.9 (SD=11.17), range=UK
Bobowik 2011b[47]	Country: Spain **Study design:** Cross-sectional Sampling: Unknown	**Sample description:** Immigrants (from Africa, South America, Eastern Europe) living in Basque country **n:** 1,171 **% female:** 47 **Mean age:** 32.45 (SD=9.05), range=UK
Bobowik 2011c[47]	Country: Spain **Study design:** Cross-sectional **Sampling:** Representative	**Sample description:** ESS participants from Spain **n:** 1,321 **% female:** 47 **Mean age:** 38.1 (SD=11.37), range=UK
Burroughs 2002[48]	Country: USA **Study design:** Cross-sectional **Sampling:** Representative	**Sample description:** Representative sample of American adults (mailing list from survey-sampling firm) **n:** 373 **% female:** 47 **Mean age:** 47 (SD=UK), range=21-74 **Other characteristics:** Race/eth: 85% White, 6% Black, 3% Hispanic, 2% Asian. Median hhold inc = $52,000; 48% college degree; 70% own home
Carver 1998[49]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Introductory psychology course students **n:** 246 **% female:** UK **Mean age:** UK (SD=UK), range=UK
Chan 2000[50]	**Country:** United Kingdom **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** University students in Britain **n:** 107 **% female:** 63 **Mean age:** 26.5 (SD=4.5), range=18-37
Christopher 2004a[26]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Undergraduate students in intro psych class for course credit **n:** 297 **% female:** 56 **Mean age:** UK (SD=UK), range=UK
Christopher 2004b[51]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Undergraduate students in intro psych class for course credit **n:** 159 **% female:** 54 **Mean age:** UK (SD=UK), range=17-23

Christopher 2007[24]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Undergraduate students from St. Mary's College of Maryland & Albion College (MI) for course credit (assuming psych course). **n:** 277 **% female:** 64 **Mean age:** 18.81 (SD=0.93), range=16-24
Christopher 2009[25]	Country: USA **Study design:** Cross-sectional **Sampling:** Online recruiting	**Sample description:** Participants "contacted by online survey service" for raffle entry **n:** 440 **% female:** 53 **Mean age:** 39 (SD=12), range=18-73
Dittmar 2011a[52]	**Country:** United Kingdom **Study design:** Cross-sectional **Sampling:** Other convenience sample	**Sample description:** Adults living in the South East of England recruited trhough "personal contacts of second author" in Sussex. **n:** 57 **% female:** 50 **Mean age:** UK (SD=UK), range=28-64 **Other characteristics:** Mean income (including student, homemaker) = £15,582 (SD=£12,805, range £0-£70,000). Mean of employed = £19.168 (SD=£7,893). 54% not in paid employment, 18% semi-skilled & manual occupation, 35% non-manual skilled & professional/managerial.
Dittmar 2011b[52]	**Country:** United Kingdom **Study design:** Cross-sectional **Sampling:** Other convenience sample	**Sample description:** Adults living in the South East of England recruited trhough "personal contacts of second author" in Sussex. **n:** 70 **% female:** 50 **Mean age:** UK (SD=UK), range=18-27 **Other characteristics:** Mean income (including student, homemaker) = £15,582 (SD=£12,805, range £0-£70,000). Mean of employed = £19.168 (SD=£7,893). 54% not in paid employment, 18% semi-skilled & manual occupation, 35% non-manual skilled & professional/managerial.
Frost 2000[53]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Undergraduate students in human sexuality course in Educational Psychology Department of large, public university in Southwest **n:** 207 **% female:** 43 **Mean age:** UK (SD=UK), range=21-22 **Other characteristics:** 40% engineering majors, 14% applied social science, 11% business, 9% natural science, 8% communiation studies
Gardordottir 2009a[54]	**Country:** United Kingdom **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** UK undergraduates from University of Sussex for course credit; questionnaires given at scheduled times for credit, others volunteered **n:** 145 **% female:** 64 **Mean age:** 24.2 (SD=6.8), range=UK **Other characteristics:** 53% worked part time at least
Gardordottir 2009b[54]	**Country:** Iceland **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Icelandic undergraduates from University of Iceland as volunteers. Questionnaires administered in research workshops. **n:** 139 **% female:** 73 **Mean age:** 24.8 (SD=5.6), range=UK **Other characteristics:** 54% worked part time at least
Gardordottir 2009c[54]	**Country:** United Kingdom **Study design:** Cross-sectional **Sampling:** Other convenience sample	**Sample description:** UK professionals working full-time identified through "employment contacts of the third author"; volunteers. Questionnaires completed online **n:** 261 **% female:** 57 **Mean age:** 38.9 (SD=10.5), range=18-63 **Other characteristics:** 59% in public (education, welfare provision), 41% in private (finance, computing) organizations in South England. Mean annual salary $76,368, SD=$111,596, median $55,483, range $5,944 - $1,585,224.
Georgellis 2009a[55]	**Country:** West Europe **Study design:** Cross-sectional **Sampling:** Representative	**Sample description:** 2002 European Social Survey (ESS) participants. Representative sample of ~2000/wave/country: Austria, Belgium, Switzerland, Germany, Ireland, Netherlands, Luxemburg. **n:** ~14,000 **% female:** 52 **Mean age:** UK (SD=UK), range=18-75
Georgellis 2009b[55]	**Country:** West Europe **Study design:** Cross-sectional **Sampling:** Representative	**Sample description:** 2004 European Social Survey (ESS) participants. Representative sample of ~2000/wave/country: Austria, Belgium, Switzerland, Germany, Ireland, Netherlands, Luxemburg. **n:** ~14,000 **% female:** 53 **Mean age:** UK (SD=UK), range=18-75
Georgellis 2009c[55]	**Country:** Scandinavia **Study design:** Cross-sectional **Sampling:** Representative	**Sample description:** 2002 European Social Survey (ESS) participants. Representative sample of ~2000/wave/country: Denmark, Sweden, Finland, Norway. **n:** ~8,000 **% female:** 52 **Mean age:** UK (SD=UK), range=18-75

Georgellis 2009d[55]	**Country:** Scandinavia **Study design:** Cross-sectional **Sampling:** Representative	**Sample description:** 2004 European Social Survey (ESS) participants. Representative sample of ~2000/wave/country: Denmark, Sweden, Finland, Norway. **n:** ~8,000 **% female:** 53 **Mean age:** UK (SD=UK), range=18-75
Georgellis 2009e[55]	**Country:** South Europe **Study design:** Cross-sectional **Sampling:** Representative	**Sample description:** 2002 European Social Survey (ESS) participants. Representative sample of ~2000/wave/country: Spain, Greece, Portugal. **n:** ~6,000 **% female:** 52 **Mean age:** UK (SD=UK), range=18-75
Georgellis 2009f[55]	**Country:** South Europe **Study design:** Cross-sectional **Sampling:** Representative	**Sample description:** 2004 European Social Survey (ESS) participants. Representative sample of ~2000/wave/country: Spain, Greece, Portugal. **n:** ~6,000 **% female:** 53 **Mean age:** UK (SD=UK), range=18-75
Gomez 2012a[56]	**Country:** Germany **Study design:** Cross-sectional **Sampling:** Other convenience sample	**Sample description:** German family members from 3 age groups (young, middle-aged, older) recruited through youngest in school presentations, ads on campus & in newspapers, personal contacts. Youngest given questionnaires for all & return by mail. Response 57%. **n:** 251 **% female:** 72 **Mean age:** 19.12 (SD=2.63), range=16-25
Gomez 2012b[56]	**Country:** Germany **Study design:** Cross-sectional **Sampling:** Other convenience sample	**Sample description:** German family members from 3 age groups (young, middle-aged, older) recruited through youngest in school presentations, ads on campus & in newspapers, personal contacts. Youngest given questionnaires for all & return by mail. Response 57%. **n:** 242 **% female:** 67 **Mean age:** 47.49 (SD=4.63), range=37-60
Gomez 2012c[56]	**Country:** Germany **Study design:** Cross-sectional **Sampling:** Other convenience sample	**Sample description:** German family members from 3 age groups (young, middle-aged, older) recruited through youngest in school presentations, ads on campus & in newspapers, personal contacts. Youngest given questionnaires for all & return by mail. Response 57%. **n:** 225 **% female:** 74 **Mean age:** 75.5 (SD=6.59), range=61-95
Haslam 2009[57]	**Country:** Australia **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Psychology undergraduates for course credit. Questionnaires administered in groups of 15-28. **n:** 180 **% female:** 74 **Mean age:** 22 (SD=3.9), range=UK
Hudders 2012[58]	**Country:** Belgium **Study design:** Cross-sectional **Sampling:** Mixed: students & other convenience	**Sample description:** Student filled out questionnaire & gave q'naires to 3 non-students. Excluded 95 outliers **n:** 2,206 **% female:** 50 **Mean age:** 40.12 (SD=17.05), range=16-88
Kashdan 2007[11]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Undergraduate student taking psychology courses from a large, Mid-Atlantic University; subsample of larger study. Questionnaires administered online for course credit. **n:** 144 **% female:** 78 **Mean age:** 23.78 (SD=7.62), range=UK **Other characteristics:** 53.5% White, 12.5% Asian, 8.3% Hisp, 5.6% Black, 4.2% Middle-Eastern, 5.6% Other
Kasser 1993a[40]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Undergraduates in intro psych class for class requirement **n:** 118 **% female:** 64 **Mean age:** UK (SD=UK), range=UK **Other characteristics:** 84 White, 20 Asian, 6 Hisp, 3 Black, 5 Other
Kasser 1993b[40]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Undergrads in upper level psychology course for extra credit **n:** 198 **% female:** 67 **Mean age:** 20 (SD=UK), range=UK **Other characteristics:** 142 White, 13 Black, 12 Asian, 6 Hisp, 4 other
Kasser 1993c[40]	Country: USA **Study design:** Cross-sectional **Sampling:** Representative (local population)	**Sample description:** 18 year olds from Rochester Longitudinal Study and their moms. Mothers identified when preparing to deliver in local hospital. Interviewed face-to-face by experienced clinician and grad student. Paid $25 for ~2 hrs **n:** 140 **% female:** 47 **Mean age:** 18 (SD=0), range=18 **Other characteristics:** Race/eth: 67% White, 31% Black, 1% Hisp, 1% other. Educ: 34% <12 yrs, 49% seniors in HS, 17% freshmen in college, 21% dropped out. 55% lived w/2 parents, 16% had/expecting child. Mothers: 67% dxed w/psych disorder, 46% unskilled/semiskilled job, 17% <HS

Kasser 1996a[18]	Country: USA **Study design:** Cross-sectional **Sampling:** Representative (local population)	**Sample description:** adults living in urban neighborhood in Rochester, NY. Randomly selected with coin flips. **n:** 100 **% female:** 76 **Mean age:** 38 (SD=13), range=UK **Other characteristics:** Race: 93% White, 5% Black. Family income: 31% <$20K, 49% $20-50K, 20% $50K+
Kasser 1996b[18]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Undergraduates in psych course at U of Rochester, for extra credit **n:** 192 **% female:** 60 **Mean age:** UK (SD=UK), range=UK **Other characteristics:** 129 White, 26 Asian, 7 Black, 5 Hispanic, 6 other
Kasser 1996c[17]	Country: USA **Study design:** Cross-sectional **Sampling:** Purposive sample	**Sample description:** Prisoners in "a college program at a maximum security correctional facility in upstate NY" **n:** 66 **% female:** 0 **Mean age:** 33 (SD=7.6), range=21-53 **Other characteristics:** 36 Black, 20 White, 9 Hispanic, 1 Native American
Kasser 2001a[59]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** US university students for credit in lower-level psychology classes at private university in northeast. Surveys administered in small groups **n:** 120 **% female:** 49 **Mean age:** UK (SD=UK), range=UK **Other characteristics:** 92 White, 28 non-white
Kasser 2001b[59]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Students at a state university in western US. Packet completed on student's own time. **n:** 261 **% female:** 61 **Mean age:** UK (SD=UK), range=UK Other characteristics: 232 White
Kasser 2002[16]	**Country:** Singapore **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Students from marketing class at National University of Singapore Business School majoring in business (39 marketing, 25 finance) **n:** 92 **% female:** 72 **Mean age:** 21.1 (SD=1.53), range=19-30 **Other characteristics:** 86 Chinese, 3 Malay, 3 Indian
Kim 2003a[19]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Undergraduate students from US universities. **n:** 215 **% female:** 57 **Mean age:** UK (SD=UK), range=UK
Kim 2003b[19]	**Country:** South Korea **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Undergraduate students from South Korean universities. Translated/back-translated. **n:** 322 **% female:** 54 **Mean age:** UK (SD=UK), range=UK
Mick 1996[60]	Country: USA **Study design:** Cross-sectional **Sampling:** Other convenience sample	**Sample description:** Quota-convenience sample recruited by marketing students. **n:** 172 **% female:** 55 **Mean age:** 40 (SD=UK), range=21-90 **Other characteristics:** 86.5% White; 49% married; 17.1% family income <=20K, 42.3% 20-50K, 40% >50K
Niemiec 2009[20]	Country: USA **Study design:** Longitudinal **Sampling:** Students	**Sample description:** Graduates of private northeastern university & mid-western 4-year college volunteered to be contacted. Response 59.8% **n:** 147 **% female:** 72 **Mean age:** UK (SD=UK), range=UK **Other characteristics:** 79.9% White, 98% Asian, 4.9% Black, 4.1% Hispanic, 1.2% Other
Reeves 2012[61]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Student volunteers at "small southeastern university." Questionnaires completed during class. **n:** 171 **% female:** 63 **Mean age:** UK (SD=UK), range=UK
Richins 1992[38]	Country: USA **Study design:** Cross-sectional **Sampling:** Mixed: students & random sample	**Sample description:** Randomly chosen samples of households in Northeastern rural area (n=119); Undergraduates at northeastern college (Umass, n=86) **n:** 119 **% female:** UK **Mean age:** UK (SD=UK), range=UK **Other characteristics:** Response rate 39.7% (community) & 43.0% (students)
Rijavec 2011[62]	**Country:** Croatia **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Croatian undergraduates: 377 from Zagreb Faculty of Teacher Education and School for Economy of Entrepreneurship, 458 from Rijeka Faculties of Engineering, Law, Medicine, and Economics. Q'aires administered in groups during class. **n:** 835 **% female:** 64 **Mean age:** UK (SD=UK), range=19-21

Roberts 2007[63]	Country: USA **Study design:** Cross-sectional **Sampling:** Online recruiting	**Sample description:** "Web panel" recruited by email & word of mouth; offered incentives to participate. # interviews limited by gender, age, income to ensure balanced sample reflecting US pop **n:** 402 **% female:** 50 **Mean age:** UK (SD=UK), range=18-65+ **Other characteristics:** Race/eth: White 86.8%; Black 3.5%; Hispanic 4.7%; Asian 2.7%; Other 2.2%. Education: <12yrs 1.0%; HS grad 12.7%; HS 1-2yrs 39.3%; college grad 36.1%; Master's 9.5%; Doctorate 1.5%. Have children: 60%. Income: <10K 3.2%; 10-20K 5.7%; 20-30K 12.2%; 30-40K
Romero 2012[64]	Country: Spain **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Advanced graduate students in Educational Sciences at a public university in Galicia, Spain (n=102), and adult volunteers known to students (n=481) **n:** 583 **% female:** 72 **Mean age:** 34.65 (SD=9.54), range=22-56 **Other characteristics:** Of non-students: Edu: 17% only primary education, 62% secondary edu, 20% attended university. Questionnaires given to participancts and returned within 10 days. Rs given personality assessment as compensation. April 2009-March 2009 (right before global
Ryan 1999a[23]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** US university students. Questionnaires completed in group sessions **n:** 47 **% female:** 0 **Mean age:** UK (SD=UK), range=UK **Other characteristics:** Selected samples from similar cities/universities (secondary city, pop < 1million, <5K students, strong research with high achieving students).
Ryan 1999b[23]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** US university students. Questionnaires completed in group sessions **n:** 69 **% female:** 100 **Mean age:** UK (SD=UK), range=UK **Other characteristics:** Selected samples from similar cities/universities (secondary city, pop < 1million, <5K students, strong research with high achieving students).
Ryan 2001[65]	**Country:** Australia **Study design:** Cross-sectional **Sampling:** Other convenience sample	**Sample description:** Volunteers "randomly recruited" from social clubs, waiting rooms, & through acquaintances in Perth metro area; 81% response **n:** 162 **% female:** 56 **Mean age:** Median 42.5 (SD=UK), range=20-65+ **Other characteristics:** 70% born in Australia; age & nativity representative of Perth metro pop. Used education & suburb data on weekly income to assign SES (income Q missing too much data).
Sagiv 2000a[66]	**Country:** Germany **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Students in humanities & social science departments, Free University of Berlin; 1994 **n:** 195 **% female:** 64 **Mean age:** 25.2 (SD=UK), range=UK
Sagiv 2000b[66]	**Country:** Germany **Study design:** Cross-sectional Sampling: Unknown	**Sample description:** Adults from "several states"; no info on how samples were selected **n:** 213 **% female:** 58 **Mean age:** 38.3 (SD=UK), range=UK
Sagiv 2000c[66]	Country: Israel **Study design:** Cross-sectional Sampling: Unknown	**Sample description:** Adults from Jerusalem; no info on how sample was selected. **n:** 170 **% female:** 57 **Mean age:** 39.9 (SD=UK), range=UK
Sagiv 2000d[66]	Country: Israel **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Psychology students at Israeli university. (German students in heterogeneous value environments) **n:** 42 **% female:** UK **Mean age:** UK (SD=UK), range=UK
Sagiv 2000e[66]	Country: Israel **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Business administration students at Israeli university. (German students in heterogeneous value environments) **n:** 40 **% female:** UK **Mean age:** UK (SD=UK), range=UK
Saunders 2000-2007[67,68]	**Country:** Australia **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Undergraduate students from University of Newcastle **n:** 302 **% female:** 75 **Mean age:** 23 (SD=UK), range=17-56 **Other characteristics:** Students: 67 from Management, 235 from Arts/Sciences

Saunders 2000a[67]	**Country:** Australia **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Undergraduate students from University of Newcastle **n:** 87 **% female:** 62 **Mean age:** 27.7 (SD=UK), range=17-60
Saunders 2007a[68]	**Country:** Australia **Study design:** Cross-sectional **Sampling:** Representative	**Sample description:** Regional random digit dial in Newcastle, New South Wales. Questionnaire completed on own time. **n:** 193 **% female:** 42 **Mean age:** 48.8 (SD=UK), range=18-91 **Other characteristics:** Employment: 47.5% professional/white collar, 2.5% blue-collar, 25% retired, 12% homemaker, 9% student, 4% unemployed.
Schmuck 2000-2001[14,21]	**Country:** Germany **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Undergraduate student volunteers at University of Goettingen in Germany. Questionnaires administered individually. **n:** 83 **% female:** 61 **Mean age:** UK (SD=UK), range=UK **Other characteristics:** 41 students in psychology, 12 in law & economics 30 in natural science
Schmuck 2001a[21]	**Country:** Germany **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** German psychology undergraduates, University of Greifswald **n:** 40 **% female:** 75 **Mean age:** 23.3 (SD=6.5), range=UK
Schmuck 2001b[21]	**Country:** Germany **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** German undergraduates, University of Goettingen **n:** 150 **% female:** 60 **Mean age:** 21.7 (SD=1.6), range=UK
Sheldon 2010[69]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Undergraduate psychology students for course credit. E & D collected at time 1, goal forecast (mediator) measured 4 weeks later. **n:** 201 **% female:** 64 **Mean age:** UK (SD=UK), range=UK
Shrum 2011[70]	Country: USA **Study design:** Cross-sectional **Sampling:** Representative	**Sample description:** Representative sample of US reflecting age, gender, income, & residence characteristics. Questionnaire mailed to Rs & returned. Response 22% **n:** 314 **% female:** 57 **Mean age:** 51 (SD=UK), range=18-88 **Other characteristics:** 20% minorities; 61% less than college education; median household income $52,000
Sirgy 1998a[71]	**Country:** Australia **Study design:** Assumed cross-sectional **Sampling:** Representative	**Sample description:** "Household respondents" from Wollongong, a university town near Sydney. Probability sample, door-to-door interviewing. Response rate 71.1% **n:** 249 **% female:** 50 **Mean age:** Median 29.6 (SD=12.4), range=UK **Other characteristics:** Median education 3.5 (SD=1.2; between 2-yr college and 4-yr college)
Sirgy 1998b[71]	Country: Canada **Study design:** Assumed cross-sectional **Sampling:** Representative	**Sample description:** "Household respondents" from Waterloo, Ontario. Probability sample, mailed surveys. Response 20.2% **n:** 180 **% female:** 24 **Mean age:** Median 45.6 (SD=13.8), range=UK **Other characteristics:** Median education 3.4 (SD=1.2; between 2-yr college and 4-yr college)
Sirgy 1998c[71]	Country: USA **Study design:** Assumed cross-sectional **Sampling:** Other convenience sample	**Sample description:** "Household respondents" from Peoria, IL. Nonprobability sampling, mailed surveys. Unclear how households/respondents were selected. Response 43.1% **n:** 233 **% female:** 40 **Mean age:** Median 48.5 (SD=16.2), range=UK **Other characteristics:** Median education 3.3 (SD=1.1; between 2-yr college and 4-yr college)
Sirgy 1998d[71]	Country: USA **Study design:** Assumed cross-sectional **Sampling:** Students	**Sample description:** Undergraduate college students at Northern Illinois University. Surveys administered in class **n:** 234 **% female:** 57 **Mean age:** Median 21.5 (SD=3.5), range=UK **Other characteristics:** Median education 3.9 (SD=0.5; between 2-yr college and 4-yr college)
Solberg 2004[72]	Country: USA **Study design:** Cross-sectional Sampling: Unknown	Sample description: "participants" **n:** 95 **% female:** UK **Mean age:** UK (SD=UK), range=UK

Srivastava 2001a[73]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** 201 business students from public university, 65 business students from private university **n:** 266 **% female:** 56 **Mean age:** 23 (SD=UK), range=UK **Other characteristics:** Average work experience 3 years
Srivastava 2001b[73]	Country: USA **Study design:** Cross-sectional **Sampling:** Purposive sample	**Sample description:** Entrepreneurs affiliated with Center for Entrepreneurship at public university. Response ~30% **n:** 145 **% female:** 19 **Mean age:** 44 (SD=UK), range=UK
Stevens 2011[74]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** US undergraduate volunteers for extra credit **n:** 64 **% female:** 56 **Mean age:** 19.84 (SD=1.32), range=18-25 **Other characteristics:** 80.6% ethnically European; 93.7% unmarried; 41.7% Catholic, 38.3% Protestant; 60.7% family income $65K+; 41.3% majoring in social science, 34.9% education
Vansteenkiste 2006[75]	**Country:** Belgium **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Belgian undergraduates majoring in business (n=119) or to become infant school teachers (n=129). Questionnaire give in small group sessions. Translation/back translation to Flemish **n:** 148 **% female:** 70 **Mean age:** UK (SD=UK), range=18-20
Wheeler 1990[76]	Country: USA **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Undergraduates in intro psych class who volunteered **n:** 115 **% female:** 60 **Mean age:** 21 (SD=UK), range=UK
Yamaguchi 2012[77]	**Country:** New Zealand **Study design:** Cross-sectional **Sampling:** Students	**Sample description:** Undergraduate students in 1st/2nd year psychology courses at University of Otago, New Zealand; for course credit. Questionnaires administered in small groups. **n:** 97 **% female:** 89 **Mean age:** 20.44 (SD=4.57), range=17-47 **Other characteristics:** 80% European, 14% Asian, 5% Other

6.1.3 Details of tests from reviewed studies

Study	Materialism measure	Outcome measure	Results	Bias	
Ahuvia 1995 n=200	Construct: Importance of material possessions Scale: MVS Reliability: UK Mean (SD): UK (UK)	Construct: Life satisfaction Scale: Delighted-Terrible response scale Reliability: N/A Mean (SD): UK (UK)	Unadjusted: r= -0.30 (p<0.001) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
Bobowik 2011a n=1361	Construct: Importance of power Scale: PVQ Reliability: UK Mean (SD): UK (UK)	Construct: Affect balance Scale: General Health Questionnaire Reliability: 0.76 PA/0.76 NA Mean (SD): UK (UK)	Unadjusted: r= -0.08 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Mod Low None
Bobowik 2011b n=1,171	Construct: Importance of power Scale: PVQ Reliability: UK Mean (SD): UK (UK)	Construct: Affect balance Scale: Bradburn Positive and Negative Affect Scale (PNA) Reliability: 0.78 PA/0.80 NA Mean (SD): UK (UK)	Unadjusted: r= -0.08 (p<0.001) Adjusted: None	E misclass D misclass Confounder control	Mod Low None
	Construct: Importance of power Scale: PVQ Reliability: UK Mean (SD): UK (UK)	Construct: Life satisfaction Scale: Other Reliability: N/A Mean (SD): UK (UK)	Unadjusted: r= -0.07 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Mod High None
Bobowik 2011c n=1,321	Construct: Importance of power Scale: PVQ Reliability: UK Mean (SD): UK (UK)	Construct: Affect balance Scale: General Health Questionnaire Reliability: 0.63 PA/0.86 NA Mean (SD): UK (UK)	Unadjusted: r= 0.04 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of power Scale: PVQ Reliability: UK Mean (SD): UK (UK)	Construct: Life satisfaction Scale: Other Reliability: N/A Mean (SD): UK (UK)	Unadjusted: r= -0.04 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod High None
Burroughs 2002 n=373	Construct: Importance of material possessions Scale: MVS Reliability: 0.84 Mean (SD): 3.3 (0.85)	Construct: Affect balance Scale: Index of General Affect (IGA) Reliability: 0.94 Mean (SD): 5.48 (1.18)	Unadjusted: r= -0.15 (p<.01) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
	Construct: Importance of material possessions Scale: MVS Reliability: 0.84 Mean (SD): 3.3 (0.85)	Construct: Life satisfaction Scale: SWLS Reliability: 0.91 Mean (SD): 4.71 (1.38)	Unadjusted: r= -0.25 (p<.01) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of material possessions Scale: MVS Reliability: 0.84 Mean (SD): 3.3 (0.85)	Construct: Anxiety Scale: Depression Anxiety Stress Scales Reliability: 0.86 Mean (SD): 2.15 (1.13)	Unadjusted: r= 0.22 (p<.01) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of material possessions Scale: MVS Reliability: 0.84 Mean (SD): 3.3 (0.85)	Construct: Depression Scale: Depression Anxiety Stress Scales Reliability: 0.93 Mean (SD): 2.26 (1.37)	Unadjusted: r= 0.18 (p<.01) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of material possessions	Construct: Stress Scale: Depression Anxiety	Unadjusted: r= 0.2 (p<.01)	E misclass D misclass	Low Low

Study	Materialism measure	Outcome measure	Results	Bias	
	Scale: MVS Reliability: 0.84 Mean (SD): 3.3 (0.85)	Stress Scales Reliability: 0.86 Mean (SD): 3.38 (1.25)	Adjusted: None	Confounder control	None
Carver 1998 n=246	Construct: Importance of financial success Scale: AI Reliability: 0.94 Mean (SD): 3.61 (0.89)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): UK (UK)	Unadjusted: None Adjusted: Unstd beta= -0.31 (p<0.0005) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
	Construct: Motive for financial success Scale: AI Reliability: 0.94 Mean (SD): 2.15 (0.88)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): UK (UK)	Unadjusted: None Adjusted: Unstd beta= -0.4 (p<0.0001) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
Chan 2000 n=107	Construct: Importance of financial success Scale: AI Reliability: 0.69 (financial success) Mean (SD): Men:17.25 (3.75), Women: 17.81 (4.26)	Construct: Happiness Scale: Oxford Happiness Inventory Reliability: 0.86 Mean (SD): Men: 39.33 (10.75), Women: 38.67 (9.19)	Unadjusted: r= -0.21 (p>0.01 unclear if p<0.05) Adjusted: Unstd beta= -0.33 (p<0.01) Std beta= -0.14 (p<0.01) Adjusted for: Age, gender, personality & aspiration subscales	E misclass D misclass Confounder control	Mod Low Mod
	Construct: Importance of financial success Scale: AI Reliability: 0.69 (financial success) Mean (SD): Men:17.25 (3.75), Women: 17.81 (4.26)	Construct: Self-Actualization Scale: ISA Reliability: 0.43 Mean (SD): M: 43.45, W 43.43 (M: 4.35, W: 4.37)	Unadjusted: r= -0.21 (p>0.01 unclear if p<0.05) Adjusted: Unstd beta= -0.38 (p<0.001) Std beta= -0.35 (p<0.001) Adjusted for: Age, gender, personality & aspiration subscales	E misclass D misclass Confounder control	Mod Mod Mod
Christopher 2004a n=297	Construct: Importance of material possessions Scale: MVS Reliability: UK Mean (SD): 50.7 (10.8)	Construct: Positive affect Scale: PANAS Reliability: UK Mean (SD): 37.1 (6)	Unadjusted: r= -0.16 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of material possessions Scale: MVS Reliability: UK Mean (SD): 50.7 (10.8)	Construct: Negative affect Scale: PANAS Reliability: UK Mean (SD): 21.3 (6.1)	Unadjusted: r= 0.15 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
Christopher 2004b n=159	Construct: Importance of material possessions Scale: MVS Reliability: UK Mean (SD): 51.2 (11)	Construct: Positive affect Scale: PANAS Reliability: UK Mean (SD): 36.8 (5)	Unadjusted: r= -0.2 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of material possessions	Construct: Negative affect Scale: PANAS	Unadjusted: r= 0.22 (p<0.01)	E misclass D misclass	Mod Mod

Study	Materialism measure	Outcome measure	Results	Bias	
	Scale: MVS Reliability: UK Mean (SD): 51.2 (11)	Reliability: UK Mean (SD): 21.3 (5.4)	Adjusted: None	Confounder control	None
Christopher 2007 n=277	Construct: Importance of material possessions Scale: MVS Reliability: 0.82 Mean (SD): 50.86 (10.48)	Construct: Life satisfaction Scale: SWLS Reliability: 0.85 Mean (SD): 25.82 (5.28)	Unadjusted: r= -0.20 (p<0.01) Adjusted: Unstd beta= -0.24 (p<0.05) Std beta= -0.48 (p<0.05) Adjusted for: Social desirability	E misclass D misclass Confounder control	Low Low Min
Christopher 2009 n=440	Construct: Importance of material possessions Scale: MVS Reliability: 0.82 Mean (SD): 3.16 (0.71)	Construct: Negative affect Scale: PANAS Reliability: 0.85 Mean (SD): 2.18 (0.85)	Unadjusted: r= 0.35 (pp<0.01) Adjusted: Unstd beta= 0.36 (SE=0.05) (p<0.01) Std beta=0.3 (p<0.01) Adjusted for: Social desirability	E misclass D misclass Confounder control	Low Low Min
	Construct: Importance of material possessions Scale: MVS Reliability: 0.82 Mean (SD): 3.16 (0.71)	Construct: Positive affect Scale: PANAS Reliability: 0.92 Mean (SD): 3.55 (0.76)	Unadjusted: r= 0 (NS) Adjusted: None	E misclass D misclass Confounder control	Low Low None
Dittmar 2011a n=57	Construct: Importance of material possessions Scale: MVS Reliability: 0.76 Mean (SD): 2.58 (0.09 (SE))	Construct: Life satisfaction Scale: SWLS Reliability: 0.86 Mean (SD): 3.83 (0.15 (SE))	Unadjusted: r= 0.06 (NS) Adjusted: Unstd beta= -0.08 (NS) Std beta= -0.05 (NS) Adjusted for: Positive affect	E misclass D misclass Confounder control	Low Low Comp
	Construct: Importance of material possessions Scale: MVS Reliability: 0.76 Mean (SD): 2.58 (0.09 (SE))	Construct: Affect balance Scale: Other Reliability: N/A Mean (SD): 4.11 (0.14 (SE))	Unadjusted: r= -0.02 (NS) Adjusted: Unstd beta= -0.11 (NS) Std beta= -0.07 (NS) Adjusted for: Life satisfaction	E misclass D misclass Confounder control	Low High Comp
Dittmar 2011b n=70	Construct: Importance of material possessions Scale: MVS Reliability: 0.76 Mean (SD): 3.11 (0.08 (SE))	Construct: Life satisfaction Scale: SWLS Reliability: 0.86 Mean (SD): 4.05 (0.10 (SE))	Unadjusted: r= -0.13 (NS) Adjusted: Unstd beta= -0.26 (p<0.05) Std beta=-0.21 (p<0.05) Adjusted for: Positive affect	E misclass D misclass Confounder control	Low Low Comp
	Construct: Importance of material possessions	Construct: Affect balance Scale: Other	Unadjusted: r= -0.2 (NS)	E misclass D misclass	Low High

Study	Materialism measure	Outcome measure	Results	Bias	
	Scale: MVS Reliability: 0.76 Mean (SE): 3.11 (0.08)	Reliability: N/A Mean (SE): 4 (0.11)	Adjusted: Unstd beta= -0.23 (p<0.05) Std beta= -0.17 (p<0.05) Adjusted for: Life satisfaction	Confounder control	Comp
Frost 2000 n=207	Construct: Importance of financial success Scale: AI Reliability: 0.79 Mean (SD): 3.67 (0.89)	Construct: Life satisfaction Scale: SWLS Reliability: 0.85 Mean (SD): UK (UK)	Unadjusted: r= -0.17 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Low Low None
Gardordottir 2009a n=145	Construct: Relative importance of financial success Scale: AI Reliability: 0.79 (financial success items), 0.75 (intrinsic) Mean (SD): -1.51 (0.97)	Construct: Life satisfaction Scale: SWLS Reliability: 0.87 Mean (SD): 3.96 (0.88)	Unadjusted: r= -0.11 (NS) Adjusted: Unstd beta= -0.15 (p<0.05, one-tailed) Std beta= -0.17 (p<0.05, one-tailed) Adjusted for: Age, gender	E misclass D misclass Confounder control	Low Low Mod
Gardordottir 2009b n=139	Construct: Relative importance of financial success Scale: AI Reliability: 0.84 (financial success items), 0.69 (intrinsic) Mean (SD): -1.23 (0.86)	Construct: Life satisfaction Scale: SWLS Reliability: 0.9 Mean (SD): 4.48 (0.9)	Unadjusted: r= -0.24 (p<0.01) Adjusted: Unstd beta= -0.20 (p<0.01, one-tailed) Std beta= -0.19 (p<0.01, one-tailed) Adjusted for: Age, gender	E misclass D misclass Confounder control	Low Low Mod
Gardordottir 2009c n=261	Construct: Relative importance of financial success Scale: AI Reliability: 0.83 (financial success items), 0.69 (intrinsic) Mean (SD): -1.65 (0.99)	Construct: Life satisfaction Scale: SWLS Reliability: 0.9 Mean (SD): 4.23 (0.82)	Unadjusted: r= -0.16 (p<0.01) Adjusted: Unstd beta=-0.16 (p<0.01 (one-tailed)) Std beta=-0.19317073170731708 (p<0.01 (one-tailed)) Adjusted for: Age, gender	E misclass D misclass Confounder control	Low Low Mod
Georgellis 2009a n=~14,000	Construct: Importance of being rich Scale: Other Reliability: N/A Mean (SD): 2.86 (UK)	Construct: Life satisfaction Scale: Other Reliability: N/A Mean (SD): 7.15 (UK)	Unadjusted: r= -0.131 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	High High None
Georgellis 2009b n=~14,000	Construct: Importance of being rich Scale: Other Reliability: N/A Mean (SD): 2.84 (UK)	Construct: Life satisfaction Scale: Other Reliability: N/A Mean (SD): 7.04 (UK)	Unadjusted: r= -0.142 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	High High None
Georgellis 2009c n=~8,000	Construct: Importance of being rich Scale: Other Reliability: N/A Mean (SD): 2.86 (UK)	Construct: Life satisfaction Scale: Other Reliability: N/A Mean (SD): 7.15 (UK)	Unadjusted: r= -0.143 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	High High None
Georgellis	Construct: Importance of	Construct: Life satisfaction	Unadjusted:	E misclass	High

Study	Materialism measure	Outcome measure	Results	Bias	
2009d n=~8,000	being rich Scale: Other Reliability: N/A Mean (SD): 2.84 (UK)	Scale: Other Reliability: N/A Mean (SD): 7.04 (UK)	r= -0.127 (p<0.01) Adjusted: None	D misclass Confounder control	High None
Georgellis 2009e n=~6,000	Construct: Importance of being rich Scale: Other Reliability: N/A Mean (SD): 2.86 (UK)	Construct: Life satisfaction Scale: Other Reliability: N/A Mean (SD): 7.15 (UK)	Unadjusted: r= 0.241 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	High High None
Georgellis 2009f n=~6,000	Construct: Importance of being rich Scale: Other Reliability: N/A Mean (SD): 2.84 (UK)	Construct: Life satisfaction Scale: Other Reliability: N/A Mean (SD): 7.04 (UK)	Unadjusted: r= 0.169 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	High High None
Gomez 2012a n=251	Construct: Importance of materialistic (extrinsic) goals Scale: Other Reliability: UK Mean (SD): 3.46 (0.72)	Construct: Summary well-being (standardized scores) Scale: Summary of standardized scales: SWLS, positive attitude in life, Berne Questionnaire of Well-being Reliability: 0.80 (SWLS), 0.80 (PAL), 0.70 (SE) Mean (SD): 3.72 (0.61)	Unadjusted: r= 0.19 (p<0.05) Adjusted: Std beta= -0.01 (p=0.89) Adjusted for: Age, importance of intrinsic goals, neuroticism, extraversion	E misclass D misclass Confounder control	High Mod Mod
Gomez 2012b n=242	Construct: Importance of materialistic (extrinsic) goals Scale: Other Reliability: UK Mean (SD): 2.99 (0.65)	Construct: Summary well-being (standardized scores) Scale: Summary of standardized scales: SWLS, positive attitude in life, Berne Questionnaire of Well-being Reliability: 0.80 (SWLS), 0.80 (PAL), 0.70 (SE) Mean (SD): 3.83 (0.48)	Unadjusted: r= 0.16 (p<0.05) Adjusted: Std beta=0.04 (p=0.66) Adjusted for: Age, importance of intrinsic goals, neuroticism, extraversion	E misclass D misclass Confounder control	High Mod Mod
Gomez 2012c n=225	Construct: Importance of materialistic (extrinsic) goals Scale: Other Reliability: UK Mean (SD): 2.87 (0.73)	Construct: Summary well-being (standardized scores) Scale: Summary of standardized scales: SWLS, positive attitude in life, Berne Questionnaire of Well-being Reliability: 0.80 (SWLS), 0.80 (PAL), 0.70 (SE) Mean (SD): 3.75 (0.57)	Unadjusted: r= 0.09 (NS) Adjusted: Std beta=-0.22 (p=0.27) Adjusted for: Age, importance of intrinsic goals, neuroticism, extraversion	E misclass D misclass Confounder control	High Mod Mod
Haslam 2009 n=180	Construct: Importance of power Scale: SVS Reliability: 0.70 (mean, values range 0.57-0.81) Mean (SD): UK (UK)	Construct: Positive affect Scale: PANAS Reliability: 0.72 Mean (SD): UK (UK)	Unadjusted: r= 0.04 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Low None
	Construct: Importance of power Scale: SVS Reliability: 0.70 (mean, values range 0.57-0.81) Mean (SD): UK (UK)	Construct: Negative affect Scale: PANAS Reliability: 0.84 Mean (SD): UK (UK)	Unadjusted: r= 0.02 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Low None
	Construct: Importance of power	Construct: Life satisfaction Scale: SWLS	Unadjusted: r= -0.09 (NS)	E misclass D misclass	Mod Low

Study	Materialism measure	Outcome measure	Results	Bias	
	Scale: SVS Reliability: 0.70 (mean, values range 0.57-0.81) Mean (SD): UK (UK)	Reliability: 0.85 Mean (SD): UK (UK)	Adjusted: None	Confounder control	None
	Construct: Importance of power Scale: SVS Reliability: 0.70 (mean, values range 0.57-0.81) Mean (SD): UK (UK)	Construct: Summary well-being Scale: Summary of standardized scales: SWLS, PANAS Reliability: 0.85 (SWLS), 0.72 (PA), 0.84 (NA) Mean (SD): UK (UK)	Unadjusted: r= -0.04 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Low None
Hudders 2012 n=2,206	Construct: Importance of material possessions Scale: MVS Reliability: 0.68 Mean (SD): UK (UK)	Construct: Life satisfaction Scale: SWLS Reliability: 0.79 Mean (SD): UK (UK)	Unadjusted: r= -0.166 (p<0.001) Adjusted: None	E misclass D misclass Confounder control	Mod Low None
	Construct: Importance of material possessions Scale: MVS Reliability: 0.68 Mean (SD): UK (UK)	Construct: Positive affect Scale: PANAS Reliability: 0.77 Mean (SD): UK (UK)	Unadjusted: r= -0.022 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Low None
	Construct: Importance of material possessions Scale: MVS Reliability: 0.68 Mean (SD): UK (UK)	Construct: Negative affect Scale: PANAS Reliability: 0.81 Mean (SD): UK (UK)	Unadjusted: r= 0.152 (p<0.001) Adjusted: None	E misclass D misclass Confounder control	Mod Low None
Kashdan 2007 n=144	Construct: Importance of material possessions Scale: MVS Reliability: 0.85 Mean (SD): 68.48 (16.99)	Construct: Positive affect Scale: PANAS Reliability: 0.85 Mean (SD): 35.27 (6.7)	Unadjusted: r= -0.07 (NS) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of material possessions Scale: MVS Reliability: 0.85 Mean (SD): 68.48 (16.99)	Construct: Negative affect Scale: PANAS Reliability: 0.88 Mean (SD): 18.75 (6.28)	Unadjusted: r= 0.25 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of material possessions Scale: MVS Reliability: 0.85 Mean (SD): 68.48 (16.99)	Construct: Depression Scale: Beck Depression Inventory Reliability: 0.9 Mean (SD): 9.62 (8.56)	Unadjusted: r= 0.33 (p<0.001) Adjusted: None	E misclass D misclass Confounder control	Low Low None
Kasser 1993a n=118	Construct: Ranked importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.72 Mean (SD): UK (UK)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.27 (pp<0.01) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
	Construct: Ranked importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.72 Mean (SD): UK (UK)	Construct: Vitality Scale: SVS Reliability: 0.83 Mean (SD): UK (UK)	Unadjusted: r= -0.23 (pp<0.05) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of financial success	Construct: Vitality Scale: SVS	Unadjusted: r= -0.13 (NS)	E misclass D misclass	Low Low

Study	Materialism measure	Outcome measure	Results	Bias	
	Scale: AI Reliability: 0.82 Mean (SD): Men: 4.0 (0.64), Women: 3.5 (0.85)	Reliability: 0.83 Mean (SD): UK (UK)	Adjusted: Unstd beta= -0.3 (p<0.05) Adjusted for: Scoring tendency	Confounder control	Min
	Construct: Importance of financial success Scale: AI Reliability: 0.82 Mean (SD): Men: 4.0 (0.64), Women: 3.5 (0.85)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.24 (p<0.05) Adjusted: Unstd beta=-0.47 (p<0.001) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
Kasser 1993b n=198	Construct: Ranked importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.76 Mean (SD): UK (UK)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= UK, negative (NS) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
	Construct: Ranked importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.76 Mean (SD): UK (UK)	Construct: Vitality Scale: SVS Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.21 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
	Construct: Ranked importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.76 Mean (SD): UK (UK)	Construct: Depression Scale: CES-D Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.28 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
	Construct: Ranked importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.76 Mean (SD): UK (UK)	Construct: Anxiety Scale: State-Trait Anxiety Inventory (STAI) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.22 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
	Construct: Importance of financial success Scale: AI Reliability: 0.71-0.86 Mean (SD): Men: 3.3 (0.67), Women: 3.1 (0.85)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.11 (NS) Adjusted: Unstd beta= -0.26 (p<0.01) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
	Construct: Importance of financial success Scale: AI Reliability: 0.71-0.86 Mean (SD): Men: 3.3 (0.67), Women: 3.1 (0.85)	Construct: Vitality Scale: SVS Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.01 (NS) Adjusted: Unstd beta= -0.16 (p<0.10) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
	Construct: Importance of financial success	Construct: Depression Scale: CES-D	Unadjusted: r= 0.09 (NS)	E misclass D misclass	Low Mod

Study	Materialism measure	Outcome measure	Results	Bias	
	Scale: AI Reliability: 0.71-0.86 Mean (SD): Men: 3.3 (0.67), Women: 3.1 (0.85)	Reliability: UK Mean (SD): UK (UK)	Adjusted: Unstd beta= 0.24 (p<0.05) Adjusted for: Scoring tendency	Confounder control	Min
	Construct: Importance of financial success Scale: AI Reliability: 0.71-0.86 Mean (SD): Men: 3.3 (0.67), Women: 3.1 (0.85)	Construct: Anxiety Scale: State-Trait Anxiety Inventory (STAI) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.18 (p<0.05) Adjusted: Unstd beta= 0.32 (p<0.01) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
Kasser 1993c n=140	Construct: Importance of financial success Scale: AI Reliability: 0.71 Mean (SD): Men: 9.6 (2.0), Women: 9.2 (2.1)	Construct: Global functioning Scale: Children's Global Assessment Scale (CGAS) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.3 (p<0.01) Adjusted: Unstd beta= -0.49 (p<0.01) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
	Construct: Importance of financial success Scale: AI Reliability: 0.71 Mean (SD): Men: 9.6 (2.0), Women: 9.2 (2.1)	Construct: Behavioral disorders Scale: DICA Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.27 (p<0.01) Adjusted: Unstd beta= 0.47 (p<0.01) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
Kasser 1996a n=100	Construct: Ranked importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.67 (mean, subscale range 0.39-0.85) Mean (SD): UK (UK)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.34 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Ranked importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.67 (mean, subscale range 0.39-0.85) Mean (SD): UK (UK)	Construct: Anxiety Scale: Hopkins Symptom Checklist (HSC) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.17 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Ranked importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.67 (mean, subscale range 0.39-0.85) Mean (SD): UK (UK)	Construct: Vitality Scale: SVS Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.09 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Ranked importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.67 (mean, subscale range 0.39-0.85) Mean (SD): UK (UK)	Construct: Physical symptoms Scale: Physical sxs (Pennebaker) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.26 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Mod Low None
	Construct: Ranked importance of materialistic	Construct: Depression Scale: CES-D	Unadjusted: r= 0.18 (p<0.10)	E misclass D misclass	Mod Mod

Study	Materialism measure	Outcome measure	Results	Bias	
	(extrinsic) goals Scale: AI Reliability: 0.67 (mean, subscale range 0.39-0.85) Mean (SD): UK (UK)	Reliability: UK Mean (SD): UK (UK)	Adjusted: None	Confounder control	None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.76 (mean, subscale range 0.59-0.87) Mean (SD): UK (UK)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): UK (UK)	Unadjusted: None Adjusted: Std beta= -0.52 (p<0.01) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.76 (mean, subscale range 0.59-0.87) Mean (SD): UK (UK)	Construct: Anxiety Scale: Hopkins Symptom Checklist (HSC) Reliability: UK Mean (SD): UK (UK)	Unadjusted: None Adjusted: Std beta= 0.25 (NS) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.76 (mean, subscale range 0.59-0.87) Mean (SD): UK (UK)	Construct: Physical symptoms Scale: Physical sxs (Pennebaker) Reliability: UK Mean (SD): UK (UK)	Unadjusted: None Adjusted: Std beta= 0.46 (p<0.05) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Low Min
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.76 (mean, subscale range 0.59-0.87) Mean (SD): UK (UK)	Construct: Vitality Scale: SVS Reliability: UK Mean (SD): UK (UK)	Unadjusted: None Adjusted: Std beta= -0.6 (pp<0.01) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.76 (mean, subscale range 0.59-0.87) Mean (SD): UK (UK)	Construct: Depression Scale: CES-D Reliability: UK Mean (SD): UK (UK)	Unadjusted: None Adjusted: Std beta=0.29 (NS) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
Kasser 1996b n=192	Construct: Ranked importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.69 (mean, subscale range 0.51-0.84) Mean (SD): Men: 9.8 (2.6), Women: 8.6 (2.7)	Construct: Positive affect Scale: Affect diary Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.25 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Mod High None
	Construct: Ranked importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.69 (mean, subscale range 0.51-0.84) Mean (SD): Men: 9.8 (2.6), Women: 8.6 (2.7)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.27 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Ranked importance of materialistic	Construct: Anxiety Scale: Hopkins Symptom	Unadjusted: r= 0.05 (NS)	E misclass D misclass	Mod Mod

Study	Materialism measure	Outcome measure	Results	Bias	
	(extrinsic) goals Scale: AI Reliability: 0.69 (mean, subscale range 0.51-0.84) Mean (SD): Men: 9.8 (2.6), Women: 8.6 (2.7)	Checklist (HSC) Reliability: UK Mean (SD): UK (UK)	Adjusted: None	Confounder control	None
	Construct: Ranked importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.69 (mean, subscale range 0.51-0.84) Mean (SD): Men: 9.8 (2.6), Women: 8.6 (2.7)	Construct: Negative affect Scale: Affect diary Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.11 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod High None
	Construct: Ranked importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.69 (mean, subscale range 0.51-0.84) Mean (SD): Men: 9.8 (2.6), Women: 8.6 (2.7)	Construct: Physical symptoms Scale: Physical sxs (Pennebaker) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.13 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Low None
	Construct: Ranked importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.69 (mean, subscale range 0.51-0.84) Mean (SD): Men: 9.8 (2.6), Women: 8.6 (2.7)	Construct: Vitality Scale: SVS Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.09 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Ranked importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.69 (mean, subscale range 0.51-0.84) Mean (SD): Men: 9.8 (2.6), Women: 8.6 (2.7)	Construct: Depression Scale: CES-D Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.03 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.82 (mean, subscale range 0.72-0.89) Mean (SD): Men: 3.4 (0.75), Women: 3.1 (0.71)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): UK (UK)	Unadjusted: None Adjusted: Std beta= -0.67 (p<0.01) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.82 (mean, subscale range 0.72-0.89) Mean (SD): Men: 3.4 (0.75), Women: 3.1 (0.71)	Construct: Positive affect Scale: Affect diary Reliability: UK Mean (SD): UK (UK)	Unadjusted: None Adjusted: Std beta= -0.35 (p<0.10) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low High Min
	Construct: Importance of materialistic (extrinsic) goals	Construct: Anxiety Scale: Hopkins Symptom	Unadjusted: None Adjusted:	E misclass D misclass	Low Mod

Study	Materialism measure	Outcome measure	Results	Bias	
	Scale: AI Reliability: 0.82 (mean, subscale range 0.72-0.89) Mean (SD): Men: 3.4 (0.75), Women: 3.1 (0.71)	Checklist (HSC) Reliability: UK Mean (SD): UK (UK)	Std beta= 0.05 (NS) Adjusted for: Scoring tendency	Confounder control	Min
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.82 (mean, subscale range 0.72-0.89) Mean (SD): Men: 3.4 (0.75), Women: 3.1 (0.71)	Construct: Negative affect Scale: Affect diary Reliability: UK Mean (SD): UK (UK)	Unadjusted: None Adjusted: Std beta= 0.06 (NS) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low High Min
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.82 (mean, subscale range 0.72-0.89) Mean (SD): Men: 3.4 (0.75), Women: 3.1 (0.71)	Construct: Physical symptoms Scale: Physical sxs (Pennebaker) Reliability: UK Mean (SD): UK (UK)	Unadjusted: None Adjusted: Std beta= 0.43 ($p<0.05$) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.82 (mean, subscale range 0.72-0.89) Mean (SD): Men: 3.4 (0.75), Women: 3.1 (0.71)	Construct: Depression Scale: CES-D Reliability: UK Mean (SD): UK (UK)	Unadjusted: None Adjusted: Std beta= 0.3 ($p<0.05$) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.82 (mean, subscale range 0.72-0.89) Mean (SD): Men: 3.4 (0.75), Women: 3.1 (0.71)	Construct: Vitality Scale: SVS Reliability: UK Mean (SD): UK (UK)	Unadjusted: None Adjusted: Std beta= -0.34 ($p<0.01$) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
Kasser 1996c n=66	Construct: Importance of financial success Scale: AI Reliability: 0.75 Mean (SD): UK (UK)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): UK (UK)	Unadjusted: None Adjusted: Std beta= -0.21 (NS) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
	Construct: Importance of financial success Scale: AI Reliability: 0.75 Mean (SD): UK (UK)	Construct: Anxiety Scale: Hopkins Symptom Checklist (HSC) Reliability: UK Mean (SD): UK (UK)	Unadjusted: None Adjusted: Std beta= 0.17 (NS) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
	Construct: Importance of financial success Scale: AI Reliability: 0.75 Mean (SD): UK (UK)	Construct: Depression Scale: Hopkins Symptom Checklist (HSC) Reliability: UK Mean (SD): UK (UK)	Unadjusted: None Adjusted: Std beta= 0.17 (NS) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
	Construct: Importance of financial success Scale: AI Reliability: 0.75 Mean (SD): UK (UK)	Construct: Physical symptoms Scale: Hopkins Symptom Checklist (HSC) Reliability: UK Mean (SD): UK (UK)	Unadjusted: None Adjusted: Std beta= -0.12 (NS) Adjusted for: Scoring tendency	E misclass D misclass Confounder control	Low Mod Min
	Construct: Importance of financial success	Construct: Vitality Scale: SVS	Unadjusted: None Adjusted:	E misclass D misclass	Low Mod

Study	Materialism measure	Outcome measure	Results	Bias	
	Scale: AI Reliability: 0.75 Mean (SD): UK (UK)	Reliability: UK Mean (SD): UK (UK)	Std beta= -0.03 (NS) Adjusted for: Scoring tendency	Confounder control	Min
Kasser 2001a n=120	Construct: Relative importance of intrinsic values to extrinsic values Scale: AI Reliability: UK Mean (SD): UK (UK)	Construct: Summary well-being (standardized scores) Scale: Summary of standardized scales: ISA, SVS, CES-D, STAI Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.36 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
Kasser 2001b n=261	Construct: Relative importance of intrinsic values to extrinsic values Scale: AI Reliability: UK Mean (SD): UK (UK)	Construct: Summary well-being (standardized scores) Scale: Summary of standardized scales: ISA, SVS, CES-D, HSC Anxiety Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.19 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
Kasser 2002 n=92	Construct: Summary of standardized materialism score Scale: Sum scale Reliability: UK Mean (SD): UK (UK)	Construct: Anxiety Scale: Hopkins Symptom Checklist (HSC) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.27 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Summary of standardized materialism score Scale: Sum scale Reliability: UK Mean (SD): UK (UK)	Construct: Happiness Scale: Fordyce-Happiness Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.24 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Summary of standardized materialism score Scale: Sum scale Reliability: UK Mean (SD): UK (UK)	Construct: Physical symptoms Scale: Physical sxs (Emmons) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.25 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Mod High None
	Construct: Summary of standardized materialism score Scale: Sum scale Reliability: UK Mean (SD): UK (UK)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.28 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Summary of standardized materialism score Scale: Sum scale Reliability: UK Mean (SD): UK (UK)	Construct: Vitality Scale: SVS Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.25 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Relative importance of intrinsic values to extrinsic values Scale: AI Reliability: UK Mean (SD): UK (UK)	Construct: Anxiety Scale: Hopkins Symptom Checklist (HSC) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.22 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Relative importance of intrinsic	Construct: Happiness Scale: Fordyce-Happiness	Unadjusted: r= -0.13 (NS)	E misclass D misclass	Mod Mod

Study	Materialism measure	Outcome measure	Results	Bias	
	values to extrinsic values Scale: AI Reliability: UK Mean (SD): UK (UK)	Reliability: UK Mean (SD): UK (UK)	Adjusted: None	Confounder control	None
	Construct: Relative importance of intrinsic values to extrinsic values Scale: AI Reliability: UK Mean (SD): UK (UK)	Construct: Physical symptoms Scale: Physical sxs (Emmons) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.19 (p<0.10) Adjusted: None	E misclass D misclass Confounder control	Mod High None
	Construct: Relative importance of intrinsic values to extrinsic values Scale: AI Reliability: UK Mean (SD): UK (UK)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.26 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Relative importance of intrinsic values to extrinsic values Scale: AI Reliability: UK Mean (SD): UK (UK)	Construct: Vitality Scale: SVS Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.23 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of material possessions Scale: MVS Reliability: UK Mean (SD): UK (UK)	Construct: Anxiety Scale: Hopkins Symptom Checklist (HSC) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.19 (p<0.10) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of material possessions Scale: MVS Reliability: UK Mean (SD): UK (UK)	Construct: Happiness Scale: Fordyce-Happiness Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.16 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of material possessions Scale: MVS Reliability: UK Mean (SD): UK (UK)	Construct: Physical symptoms Scale: Physical sxs (Emmons) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.20 (p<0.10) Adjusted: None	E misclass D misclass Confounder control	Mod High None
	Construct: Importance of material possessions Scale: MVS Reliability: UK Mean (SD): UK (UK)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.22 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of material possessions Scale: MVS Reliability: UK Mean (SD): UK (UK)	Construct: Vitality Scale: SVS Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.13 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
Kim 2003a n=215	Construct: Relative importance of intrinsic to extrinsic values Scale: AI Reliability: 0.67 (intrinsic goals), 0.79 (extrinsic goals) Mean (SD): UK (UK)	Construct: Vitality Scale: SVS Reliability: 0.86 Mean (SD): UK (UK)	Unadjusted: None Adjusted: Unstd beta=0.07 (NS) Adjusted for: Relative independent-interdependent self-concept	E misclass D misclass Confounder control	Mod Low Min
	Construct: Relative importance of intrinsic to	Construct: Anxiety Scale: Hopkins Symptom	Unadjusted: None Adjusted:	E misclass D misclass	Mod Low

Study	Materialism measure	Outcome measure	Results	Bias	
	extrinsic values Scale: AI Reliability: 0.67 (intrinsic goals), 0.79 (extrinsic goals) Mean (SD): UK (UK)	Checklist (HSC) Reliability: 0.84 Mean (SD): UK (UK)	Unstd beta=-0.12 (p<0.10) Adjusted for: Relative independent-interdependent self-concept	Confounder control	Min
	Construct: Relative importance of intrinsic values to extrinsic values Scale: AI Reliability: 0.67 (intrinsic goals), 0.79 (extrinsic goals) Mean (SD): UK (UK)	Construct: Physical symptoms Scale: Physical sxs (Emmons) Reliability: 0.79 Mean (SD): UK (UK)	Unadjusted: None Adjusted: Unstd beta=-0.15 (p<0.05) Adjusted for: Relative independent-interdependent self-concept	E misclass	Mod
				D misclass	Mod
				Confounder control	Min
	Construct: Relative importance of intrinsic to extrinsic values Scale: AI Reliability: 0.67 (intrinsic goals), 0.79 (extrinsic goals) Mean (SD): UK (UK)	Construct: Self-Actualization Scale: ISA Reliability: 0.64 Mean (SD): UK (UK)	Unadjusted: None Adjusted: Unstd beta=0.33 (p<0.001) Adjusted for: Relative independent-interdependent self-concept	E misclass	Mod
				D misclass	Mod
				Confounder control	Min
Kim 2003b n=322	Construct: Relative importance of intrinsic to extrinsic values Scale: AI Reliability: 0.67 (intrinsic goals), 0.79 (extrinsic goals) Mean (SD): UK (UK)	Construct: Vitality Scale: SVS Reliability: 0.86 Mean (SD): UK (UK)	Unadjusted: None Adjusted: Unstd beta=0.03 (NS) Adjusted for: Relative independent-interdependent self-concept	E misclass	Mod
				D misclass	Low
				Confounder control	Min
	Construct: Relative importance of intrinsic to extrinsic values Scale: AI Reliability: 0.67 (intrinsic goals), 0.79 (extrinsic goals) Mean (SD): UK (UK)	Construct: Anxiety Scale: Hopkins Symptom Checklist (HSC) Reliability: 0.84 Mean (SD): UK (UK)	Unadjusted: None Adjusted: Unstd beta= -0.11 (p<0.10) Adjusted for: Relative independent-interdependent self-concept	E misclass	Mod
				D misclass	Low
				Confounder control	Min
	Construct: Relative importance of intrinsic to extrinsic values Scale: AI Reliability: 0.67 (intrinsic goals), 0.79 (extrinsic goals) Mean (SD): UK (UK)	Construct: Physical symptoms Scale: Physical sxs (Emmons) Reliability: 0.79 Mean (SD): UK (UK)	Unadjusted: None Adjusted: Unstd beta= -0.18 (p<0.01) Adjusted for: Relative independent-interdependent self-concept	E misclass	Mod
				D misclass	Mod
				Confounder control	Min
	Construct: Relative importance of intrinsic to extrinsic values Scale: AI Reliability: 0.67 (intrinsic goals), 0.79 (extrinsic goals) Mean (SD): UK (UK)	Construct: Self-Actualization Scale: ISA Reliability: 0.64 Mean (SD): UK (UK)	Unadjusted: None Adjusted: Unstd beta=0.36 (p<0.001) Adjusted for: Relative independent-interdependent self-concept	E misclass	Mod
				D misclass	Mod
				Confounder control	Min
Mick 1996 n=172	Construct: Importance of material possessions	Construct: Self-Actualization Scale: ISA	Unadjusted: r= -0.24 (p<0.001)	E misclass	Low
				D misclass	Mod

Study	Materialism measure	Outcome measure	Results	Bias	
	Scale: MVS Reliability: 0.85 Mean (SD): 50.17 (11.48)	Reliability: 0.66 Mean (SD): 53.7 (6.64)	Adjusted: None	Confounder control	None
Niemiec 2009 n=147	Construct: Importance of image Scale: AI Reliability: 0.84 Mean (SD): 3.46 (1.32)	Construct: Anxiety Scale: State-Trait Anxiety Inventory (STAI) Reliability: 0.84 Mean (SD): 3.09 (1.32)	Unadjusted: r= 0.21 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of image Scale: AI Reliability: 0.84 Mean (SD): 3.46 (1.32)	Construct: Physical symptoms Scale: Physical sxs (Pennebaker) Reliability: 0.84 Mean (SD): 2.47 (0.99)	Unadjusted: r= 0.23 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of image Scale: AI Reliability: 0.84 Mean (SD): 3.46 (1.32)	Construct: Life satisfaction Scale: SWLS Reliability: 0.87 Mean (SD): 3.05 (0.77)	Unadjusted: r= -0.02 (NS) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of fame Scale: AI Reliability: 0.85 Mean (SD): 3 (1.21)	Construct: Anxiety Scale: State-Trait Anxiety Inventory (STAI) Reliability: 0.84 Mean (SD): 3.09 (1.32)	Unadjusted: r= 0.21 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of image Scale: AI Reliability: 0.84 Mean (SD): 3.46 (1.32)	Construct: Negative affect Scale: PANAS Reliability: 0.88 Mean (SD): 2.96 (1.23)	Unadjusted: r= 0.17 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of fame Scale: AI Reliability: 0.85 Mean (SD): 3 (1.21)	Construct: Physical symptoms Scale: Physical sxs (Pennebaker) Reliability: 0.84 Mean (SD): 2.47 (0.99)	Unadjusted: r= 0.22 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of fame Scale: AI Reliability: 0.85 Mean (SD): 3 (1.21)	Construct: Life satisfaction Scale: SWLS Reliability: 0.87 Mean (SD): 3.05 (0.77)	Unadjusted: r= 0.06 (NS) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of fame Scale: AI Reliability: 0.85 Mean (SD): 3 (1.21)	Construct: Negative affect Scale: PANAS Reliability: 0.88 Mean (SD): 2.96 (1.23)	Unadjusted: r= 0.22 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of financial success Scale: AI Reliability: 0.9 Mean (SD): 3.8 (1.39)	Construct: Negative affect Scale: PANAS Reliability: 0.88 Mean (SD): 2.96 (1.23)	Unadjusted: r= 0.07 (NS) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of financial success Scale: AI Reliability: 0.9 Mean (SD): 3.8 (1.39)	Construct: Anxiety Scale: State-Trait Anxiety Inventory (STAI) Reliability: 0.84 Mean (SD): 3.09 (1.32)	Unadjusted: r= 0.11 (NS) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of image	Construct: Positive affect Scale: PANAS	Unadjusted: r= 0.09 (NS)	E misclass D misclass	Low Low

Study	Materialism measure	Outcome measure	Results	Bias	
	Scale: AI Reliability: 0.84 Mean (SD): 3.46 (1.32)	Reliability: 0.91 Mean (SD): 5.16 (0.94)	Adjusted: None	Confounder control	None
	Construct: Importance of financial success Scale: AI Reliability: 0.9 Mean (SD): 3.8 (1.39)	Construct: Physical symptoms Scale: Physical sxs (Pennebaker) Reliability: 0.84 Mean (SD): 2.47 (0.99)	Unadjusted: r= 0.07 (NS) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of financial success Scale: AI Reliability: 0.9 Mean (SD): 3.8 (1.39)	Construct: Life satisfaction Scale: SWLS Reliability: 0.87 Mean (SD): 3.05 (0.77)	Unadjusted: r= 0.03 (NS) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of fame Scale: AI Reliability: 0.85 Mean (SD): 3 (1.21)	Construct: Positive affect Scale: PANAS Reliability: 0.91 Mean (SD): 5.16 (0.94)	Unadjusted: r= 0.20 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of financial success Scale: AI Reliability: 0.9 Mean (SD): 3.8 (1.39)	Construct: Positive affect Scale: PANAS Reliability: 0.91 Mean (SD): 5.16 (0.94)	Unadjusted: r= 0.05 (NS) Adjusted: None	E misclass D misclass Confounder control	Low Low None
Reeves 2012 n=171	Construct: Importance of material possessions Scale: MVS Reliability: 0.84 Mean (SD): 52.36 (11.1)	Construct: Life satisfaction Scale: SWLS Reliability: 0.82 Mean (SD): 15.92 (6.01)	Unadjusted: r= -0.13 (p<0.05, one-tailed) Adjusted: None	E misclass D misclass Confounder control	Low Low None
Richins 1992 n=119	Construct: Importance of material possessions Scale: MVS Reliability: 0.80-0.88 Mean (SD): 45.9 (9.8)	Construct: Life satisfaction Scale: Delighted-Terrible response scale Reliability: N/A Mean (SD): UK (UK)	Unadjusted: r= -0.32 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
Roberts 2007 n=402	Construct: Importance of material possessions Scale: MVS Reliability: 0.87 Mean (SD): 40.9 (9.4)	Construct: Life satisfaction Scale: Other Reliability: N/A Mean (SD): 3.6 (0.99)	Unadjusted: r= -0.32 (p<0.001) Adjusted: None	E misclass D misclass Confounder control	Low High None
Romero 2012 n=583	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.89 Mean (SD): 3.61 (1.02)	Construct: Positive affect Scale: PANAS Reliability: 0.79 Mean (SD): 34.47 (0.45)	Unadjusted: r= 0.05 (NS) Adjusted: Unstd beta= -0.12 (p<0.01) Std beta= -0.27 (p<0.01) Adjusted for: Age, gender, importance of intrinsic goals,	E misclass D misclass Confounder control	Low Low Mod
	Construct: Importance of materialistic (extrinsic) goals	Construct: Negative affect Scale: PANAS	Unadjusted: r= 0.12 (p<0.01)	E misclass D misclass	Low Low

Study	Materialism measure	Outcome measure	Results	Bias	
	Scale: AI Reliability: 0.89 Mean (SD): 3.61 (1.02)	Reliability: 0.84 Mean (SD): 23.62 (7.1)	Adjusted: Unstd beta= 0.19 (p<0.001) Std beta= 0.03 (p<0.001) Adjusted for: Age, gender, importance of intrinsic goals,	Confounder control	Mod
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.89 Mean (SD): 3.61 (1.02)	Construct: Life satisfaction Scale: SWLS Reliability: 0.78 Mean (SD): 23.65 (6.02)	Unadjusted: r= -0.03 (NS) Adjusted: Unstd beta= -0.04 (NS) Std beta= -0.01 (NS) Adjusted for: Age, gender, importance of intrinsic goals,	E misclass D misclass Confounder control	Low Low Mod
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.89 Mean (SD): 3.61 (1.02)	Construct: Summary well-being (standardized scores) Scale: Summary of standardized scales: SWLS, PANAS Reliability: UK Mean (SD): 0 (2.17)	Unadjusted: r= -0.04 (NS) Adjusted: Unstd beta= -0.15 (p<0.01) Std beta= -0.07 (p<0.01) Adjusted for: Age, gender, importance of intrinsic goals,	E misclass D misclass Confounder control	Low Mod Mod
Ryan 1999a n=47	Construct: Relative importance of intrinsic to extrinsic values Scale: AI Reliability: 0.91-0.94 Mean (SD): Intrinsic: 4.40 (UK), Extrinsic: 2.99 (UK)	Construct: Life satisfaction Scale: SWLS Reliability: UK Mean (SD): 4 (UK)	Unadjusted: r= 0.16 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
	Construct: Relative importance of intrinsic to extrinsic values Scale: AI Reliability: 0.91-0.94 Mean (SD): Intrinsic: 4.40 (UK), Extrinsic: 2.99 (UK)	Construct: Lack of depression Scale: CES-D Reliability: UK Mean (SD): 4 (UK)	Unadjusted: r= 0.34 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
	Construct: Relative importance of intrinsic to extrinsic values Scale: AI Reliability: 0.91-0.94 Mean (SD): Intrinsic: 4.40 (UK), Extrinsic: 2.99 (UK)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): 4 (UK)	Unadjusted: r= 0.42 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
	Construct: Relative rank of intrinsic goals to extrinsic goals Scale: AI Reliability: 0.91-0.94 Mean (SD): Intrinsic: 2.99 (UK), Extrinsic: 1.46 (UK)	Construct: Life satisfaction Scale: SWLS Reliability: UK Mean (SD): 4 (UK)	Unadjusted: r= 0.25 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
	Construct: Relative rank of	Construct: Lack of depression	Unadjusted:	E misclass	Low

Study	Materialism measure	Outcome measure	Results	Bias	
	intrinsic goals to extrinsic goals Scale: AI Reliability: 0.91-0.94 Mean (SD): Intrinsic: 2.99 (UK), Extrinsic: 1.46 (UK)	Scale: CES-D Reliability: UK Mean (SD): 4 (UK)	r= 0.34 (p<0.01) Adjusted: None	D misclass Confounder control	Mod None
	Construct: Relative rank of intrinsic goals to extrinsic goals Scale: AI Reliability: 0.91-0.94 Mean (SD): Intrinsic: 2.99 (UK), Extrinsic: 1.46 (UK)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): 4 (UK)	Unadjusted: r= 0.34 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
Ryan 1999b n=69	Construct: Relative importance of intrinsic values to extrinsic values Scale: AI Reliability: 0.91-0.94 Mean (SD): Intrinsic: 4.74 (UK), Extrinsic: 2.99 (UK)	Construct: Life satisfaction Scale: SWLS Reliability: UK Mean (SD): 4 (UK)	Unadjusted: r= 0.25 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
	Construct: Relative importance of intrinsic values to extrinsic values Scale: AI Reliability: 0.91-0.94 Mean (SD): Intrinsic: 4.74 (UK), Extrinsic: 2.99 (UK)	Construct: Lack of depression Scale: CES-D Reliability: UK Mean (SD): 4 (UK)	Unadjusted: r= 0.16 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
	Construct: Relative importance of intrinsic values to extrinsic values Scale: AI Reliability: 0.91-0.94 Mean (SD): Intrinsic: 4.74 (UK), Extrinsic: 2.99 (UK)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): 4.18 (UK)	Unadjusted: r= 0.56 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
	Construct: Relative rank of intrinsic goals to extrinsic goals Scale: AI Reliability: 0.91-0.94 Mean (SD): Intrinsic: 2.99 (UK), Extrinsic: 1.12 (UK)	Construct: Life satisfaction Scale: SWLS Reliability: UK Mean (SD): 4 (UK)	Unadjusted: r= 0.16 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
	Construct: Relative rank of intrinsic goals to extrinsic goals Scale: AI Reliability: 0.91-0.94 Mean (SD): Intrinsic: 2.99 (UK), Extrinsic: 1.12 (UK)	Construct: Lack of depression Scale: CES-D Reliability: UK Mean (SD): 4 (UK)	Unadjusted: r= 0.16 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
	Construct: Relative rank of intrinsic goals to extrinsic goals Scale: AI Reliability: 0.91-0.94 Mean (SD): Intrinsic: 2.99 (UK), Extrinsic: 1.12 (UK)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): 4.18 (UK)	Unadjusted: r= 0.42 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
Ryan 2001	Construct: Importance of	Construct: Life satisfaction	Unadjusted:	E misclass	Low

Study	Materialism measure	Outcome measure	Results	Bias	
n=162	material possessions Scale: MVS Reliability: 0.85 Mean (SD): 51.9 (13.8)	Scale: Delighted-Terrible response scale Reliability: N/A Mean (SD): 5.4 (0.9)	r= -0.28 (p<0.001) Adjusted: None	D misclass Confounder control	Mod None
Sagiv 2000a n=195	Construct: Importance of power Scale: SVS Reliability: 0.66 Mean (SD): UK (UK)	Construct: General mental health Scale: General Mental Health Scale from Trier Personality Inventory Reliability: 0.87 Mean (SD): 2.9 (0.38)	Unadjusted: r= 0.06 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Low None
	Construct: Importance of power Scale: SVS Reliability: 0.66 Mean (SD): UK (UK)	Construct: Life satisfaction Scale: SWLS Reliability: 0.77 Mean (SD): 4.5 (1.04)	Unadjusted: r= -0.03 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Low None
	Construct: Importance of power Scale: SVS Reliability: 0.66 Mean (SD): UK (UK)	Construct: Positive affect Scale: Bradburn Positive and Negative Affect Scale (PNA) Reliability: 0.59 Mean (SD): 1.74 (0.28)	Unadjusted: r= -0.15 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
Sagiv 2000b n=213	Construct: Importance of power Scale: SVS Reliability: 0.66 Mean (SD): UK (UK)	Construct: General mental health Scale: General Mental Health Scale from Trier Personality Inventory Reliability: 0.87 Mean (SD): 3.03 (0.33)	Unadjusted: r= 0.12 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Low None
	Construct: Importance of power Scale: SVS Reliability: 0.66 Mean (SD): UK (UK)	Construct: Life satisfaction Scale: SWLS Reliability: 0.77 Mean (SD): 4.84 (0.85)	Unadjusted: r= -0.01 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Low None
	Construct: Importance of power Scale: SVS Reliability: 0.66 Mean (SD): UK (UK)	Construct: Positive affect Scale: Bradburn Positive and Negative Affect Scale (PNA) Reliability: 0.59 Mean (SD): 1.86 (0.27)	Unadjusted: r= 0.00 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
Sagiv 2000c n=170	Construct: Importance of power Scale: SVS Reliability: 0.66 Mean (SD): UK (UK)	Construct: General mental health Scale: General Mental Health Scale from Trier Personality Inventory Reliability: 0.87 Mean (SD): 3.18 (0.32)	Unadjusted: r= 0.08 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Low None
	Construct: Importance of power Scale: SVS Reliability: 0.66 Mean (SD): UK (UK)	Construct: Life satisfaction Scale: SWLS Reliability: 0.77 Mean (SD): 4.64 (1.03)	Unadjusted: r= -0.14 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Mod Low None
	Construct: Importance of power Scale: SVS Reliability: 0.66 Mean (SD): UK (UK)	Construct: Positive affect Scale: Bradburn Positive and Negative Affect Scale (PNA) Reliability: 0.59 Mean (SD): 1.75 (0.25)	Unadjusted: r= -0.09 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
Sagiv 2000d	Construct: Importance of	Construct: General mental	Unadjusted:	E misclass	Mod

Study	Materialism measure	Outcome measure	Results	Bias	
n=42	power Scale: SVS Reliability: 0.66 Mean (SD): UK (UK)	health Scale: General Mental Health Scale from Trier Personality Inventory Reliability: 0.87 Mean (SD): UK (UK)	r= -0.17 (NS) Adjusted: None	D misclass	Low
				Confounder control	None
	Construct: Importance of power Scale: SVS Reliability: 0.66 Mean (SD): UK (UK)	Construct: Positive affect Scale: Bradburn Positive and Negative Affect Scale (PNA) Reliability: 0.59 Mean (SD): UK (UK)	Unadjusted: r= -0.34 (p<0.05) Adjusted: None	E misclass	Mod
				D misclass	Mod
				Confounder control	None
	Construct: Importance of power Scale: SVS Reliability: 0.66 Mean (SD): UK (UK)	Construct: Life satisfaction Scale: SWLS Reliability: 0.77 Mean (SD): UK (UK)	Unadjusted: r= -0.26 (p<0.05) Adjusted: None	E misclass	Mod
				D misclass	Low
				Confounder control	None
Sagiv 2000e n=40	Construct: Importance of power Scale: SVS Reliability: 0.66 Mean (SD): UK (UK)	Construct: General mental health Scale: General Mental Health Scale from Trier Personality Inventory Reliability: 0.87 Mean (SD): UK (UK)	Unadjusted: r= 0.34 (p<0.05) Adjusted: None	E misclass	Mod
				D misclass	Low
				Confounder control	None
	Construct: Importance of power Scale: SVS Reliability: 0.66 Mean (SD): UK (UK)	Construct: Positive affect Scale: Bradburn Positive and Negative Affect Scale (PNA) Reliability: 0.59 Mean (SD): UK (UK)	Unadjusted: r= 0.17 (NS) Adjusted: None	E misclass	Mod
				D misclass	Mod
				Confounder control	None
	Construct: Importance of power Scale: SVS Reliability: 0.66 Mean (SD): UK (UK)	Construct: Life satisfaction Scale: SWLS Reliability: 0.77 Mean (SD): UK (UK)	Unadjusted: r= 0.27 (p<0.05) Adjusted: None	E misclass	Mod
				D misclass	Low
				Confounder control	None
Saunders 2000-2007 n=302	Construct: Importance of material possessions Scale: MVS Reliability: 0.82 Mean (SD): UK (UK)	Construct: Anxiety Scale: Beck Anxiety Index Reliability: 0.88 Mean (SD): UK (UK)	Unadjusted: r= 0.19 (p<0.01) Adjusted: None	E misclass	Low
				D misclass	Low
				Confounder control	None
	Construct: Importance of material possessions Scale: MVS Reliability: 0.85 Mean (SD): UK (UK)	Construct: Depression Scale: Beck Depression Inventory Reliability: 0.87 Mean (SD): UK (UK)	Unadjusted: r= 0.21 (p<0.001) Adjusted: None	E misclass	Low
				D misclass	Low
				Confounder control	None
Saunders 2000a n=87	Construct: Importance of material possessions Scale: MVS Reliability: 0.85 Mean (SD): UK (UK)	Construct: Life satisfaction Scale: SWLS Reliability: 0.7 Mean (SD): UK (UK)	Unadjusted: r= -0.26 (p<0.05) Adjusted: None	E misclass	Low
				D misclass	Low
				Confounder control	None
	Construct: Importance of material possessions Scale: MVS Reliability: 0.85 Mean (SD): UK (UK)	Construct: Depression Scale: Beck Depression Inventory Reliability: 0.83 Mean (SD): UK (UK)	Unadjusted: r= 0.22 (p<0.05) Adjusted: None	E misclass	Low
				D misclass	Low
				Confounder control	None
Saunders 2007a	Construct: Importance of material possessions	Construct: Life satisfaction Scale: SWLS	Unadjusted: r= -0.41 (p<0.001)	E misclass	Low
				D misclass	Low

Study	Materialism measure	Outcome measure	Results	Bias	
n=193	Scale: MVS Reliability: 0.8 Mean (SD): UK (UK)	Reliability: 0.87 Mean (SD): UK (UK)	Adjusted: None	Confounder control	None
Schmuck 2000-2001 n=83	Construct: Relative importance of intrinsic to extrinsic values Scale: AI Reliability: UK Mean (SD): Intrinsic: 4.12 (0.34), Extrinsic: 2.53 (0.56)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.35 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Relative importance of intrinsic to extrinsic values Scale: AI Reliability: UK Mean (SD): Intrinsic: 4.12 (0.34), Extrinsic: 2.53 (0.56)	Construct: General well-being Scale: Summary of standardized scales: ISA, SVS, CES-D, STAI, Pennebaker physical sxs Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.26 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Relative importance of intrinsic to extrinsic values Scale: AI Reliability: UK Mean (SD): Intrinsic: 4.12 (0.34), Extrinsic: 2.53 (0.56)	Construct: Vitality Scale: SVS Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.01 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: UK Mean (SD): 2.5 (0.61)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.35 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: UK Mean (SD): 2.5 (0.61)	Construct: Summary well-being (standardized scores) Scale: Summary of standardized scales: ISA, SVS, CES-D, STAI, Pennebaker physical symptoms Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.26 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: UK Mean (SD): 2.5 (0.61)	Construct: Vitality Scale: SVS Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.01 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Relative importance of intrinsic to extrinsic values Scale: AI Reliability: UK Mean (SD): Intrinsic: 4.12 (0.34), Extrinsic: 2.53 (0.56)	Construct: Anxiety Scale: State-Trait Anxiety Inventory (STAI) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.25 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Relative importance of intrinsic to extrinsic values Scale: AI Reliability: UK Mean (SD): Intrinsic: 4.12 (0.34), Extrinsic: 2.53 (0.56)	Construct: Depression Scale: CES-D Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.11 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None

Study	Materialism measure	Outcome measure	Results	Bias	
	Construct: Relative importance of intrinsic to extrinsic values Scale: AI Reliability: UK Mean (SD): Intrinsic: 4.12 (0.34), Extrinsic: 2.53 (0.56)	Construct: Physical symptoms Scale: Physical sxs (Pennebaker) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.17 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: UK Mean (SD): 2.5 (0.61)	Construct: Anxiety Scale: State-Trait Anxiety Inventory (STAI) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.25 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: UK Mean (SD): 2.5 (0.61)	Construct: Depression Scale: CES-D Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.11 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: UK Mean (SD): 2.5 (0.61)	Construct: Physical symptoms Scale: Physical sxs (Pennebaker) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.17 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
Schmuck 2001a n=40	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: UK Mean (SD): 2.82 (0.68)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.28 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: UK Mean (SD): 2.82 (0.68)	Construct: Summary well-being (standardized scores) Scale: Summary of standardized scales: ISA, SVS, CES-D, STAI, Pennebaker physical sxs Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.37 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: UK Mean (SD): 2.82 (0.68)	Construct: Vitality Scale: SVS Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.35 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: UK Mean (SD): 2.82 (0.68)	Construct: Anxiety Scale: State-Trait Anxiety Inventory (STAI) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.18 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: UK Mean (SD): 2.82 (0.68)	Construct: Depression Scale: CES-D Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.32 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: UK Mean (SD): 2.82 (0.68)	Construct: Physical symptoms Scale: Physical sxs (Pennebaker) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.24 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
Schmuck	Construct: Importance of	Construct: Happiness	Unadjusted:	E misclass	Mod

Study	Materialism measure	Outcome measure	Results	Bias	
2001b n=150	materialistic (extrinsic) goals Scale: AI Reliability: UK Mean (SD): 4.85 (1.35)	Scale: Fordyce-Happiness Reliability: UK Mean (SD): UK (UK)	r= -0.07 (NS) Adjusted: None	D misclass Confounder control	Mod None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: UK Mean (SD): 4.85 (1.35)	Construct: Self-Actualization Scale: ISA Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.39 (p<0.001) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: UK Mean (SD): 4.85 (1.35)	Construct: Summary well-being (standardized scores) Scale: Summary of standardized scales: ISA, SVS, Fordyce-Happiness, HSC Anxiety, Pennebaker physical symptoms Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.20 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: UK Mean (SD): 4.85 (1.35)	Construct: Vitality Scale: SVS Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.22 (p<0.01) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: UK Mean (SD): 4.85 (1.35)	Construct: Physical symptoms Scale: Physical sxs (Pennebaker) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.08 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: UK Mean (SD): 4.85 (1.35)	Construct: Anxiety Scale: Hopkins Symptom Checklist (HSC) Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.00 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
Sheldon 2010 n=201	Construct: Relative importance of extrinsic goals to intrinsic goals Scale: AI Reliability: 0.85 Mean (SD): -1.39 (0.9)	Construct: Summary well-being (standardized scores) Scale: Summary of standardized scales: SWLS, PANAS Reliability: 0.88 Mean (SD): 4.84 (1.65)	Unadjusted: r= -0.16 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.93 Mean (SD): 2.95 (0.83)	Construct: Summary well-being (standardized scores) Scale: Summary of standardized scales: SWLS, PANAS Reliability: 0.88 Mean (SD): 4.84 (1.65)	Unadjusted: r= 0.04 (NS) Adjusted: None	E misclass D misclass Confounder control	Low Low Min
Shrum 2011 n=314	Construct: Importance of material possessions	Construct: Life satisfaction Scale: SWLS	Unadjusted: None Adjusted:	E misclass D misclass	Low Low

Study	Materialism measure	Outcome measure	Results	Bias	
	Scale: MVS Reliability: 0.84 Mean (SD): UK (UK)	Reliability: 0.88 Mean (SD): UK (UK)	Std beta=-0.28 (p<0.001) Adjusted for: Age; gender; education; income; social desirability; level of TV watching; usage of other media	Confounder control	Comp
Sirgy 1998a n=249	Construct: Importance of material possessions Scale: MVS Reliability: 0.62 Mean (SD): 2.94 (0.72)	Construct: Life satisfaction Scale: Congruity Life Satisfaction Reliability: 0.9 Mean (SD): 3.91 (0.82)	Unadjusted: r= -0.213 (p=UK) Adjusted: None	E misclass D misclass Confounder control	Mod Low Min
Sirgy 1998b n=180	Construct: Importance of material possessions Scale: MVS Reliability: 0.52 Mean (SD): 3.29 (0.59)	Construct: Life satisfaction Scale: Congruity Life Satisfaction Reliability: 0.91 Mean (SD): 4.5 (1.06)	Unadjusted: r= 0.384 (p=UK) Adjusted: None	E misclass D misclass Confounder control	Mod Low Min
Sirgy 1998c n=233	Construct: Importance of material possessions Scale: MVS Reliability: 0.69 Mean (SD): 2.86 (0.74)	Construct: Life satisfaction Scale: Congruity Life Satisfaction Reliability: 0.93 Mean (SD): 4.47 (1.01)	Unadjusted: r= -0.346 (p=UK) Adjusted: None	E misclass D misclass Confounder control	Mod Low Min
Sirgy 1998d n=234	Construct: Importance of material possessions Scale: MVS Reliability: 0.59 Mean (SD): 3.17 (0.68)	Construct: Life satisfaction Scale: Congruity Life Satisfaction Reliability: 0.84 Mean (SD): 4.42 (0.74)	Unadjusted: r= -0.224 (p=UK) Adjusted: None	E misclass D misclass Confounder control	Mod Low Min
Solberg 2004 n=95	Construct: Importance of material possessions Scale: MVS Reliability: UK Mean (SD): UK (UK)	Construct: Life satisfaction Scale: SWLS Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.20 (p=0.06) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of material possessions Scale: MVS Reliability: UK Mean (SD): UK (UK)	Construct: Positive affect Scale: PANAS Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.17 (p=0.1) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of material possessions Scale: MVS Reliability: UK Mean (SD): UK (UK)	Construct: Positive affect Scale: PDA affect Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.23 (p=0.03) Adjusted: None	E misclass D misclass Confounder control	Mod High None
	Construct: Importance of material possessions Scale: MVS Reliability: UK Mean (SD): UK (UK)	Construct: Negative affect Scale: PANAS Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.23 (p=0.03) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of material possessions Scale: MVS Reliability: UK Mean (SD): UK (UK)	Construct: Negative affect Scale: PDA affect Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.32 (p=0.002) Adjusted: None	E misclass D misclass Confounder control	Mod High None
Srivastava 2001a	Construct: Imp score for financial success (% of 100)	Construct: SWB Scale: Mental Health Index	Unadjusted: r= -0.11 (NS)	E misclass D misclass	High Low

Study	Materialism measure	Outcome measure	Results	Bias	
n=266	Scale: Other Reliability: UK Mean (SD): 24.37 (15.3)	Reliability: 0.95 Mean (SD): 4.11 (0.75)	Adjusted: Unstd beta= -0.01 (SE=0.00, p<0.05) Std beta= -0.13 (p<0.05) Adjusted for: gender, family income	Confounder control	Comp
Srivastava 2001b n=145	Construct: Imp score for financial success (% of 100) Scale: Other Reliability: UK Mean (SD): 22.78 (14.46)	Construct: SWB Scale: Mental Health Index Reliability: UK Mean (SD): 4.25 (0.58)	Unadjusted: r= -.21 (p<0.01) Adjusted: Unstd beta= -0.01 (SE=0.00, p<0.05) Std beta= -0.2 (p<0.05) Adjusted for: gender, family income	E misclass D misclass Confounder control	High Mod Comp
Stevens 2011 n=64	Construct: Importance of financial success Scale: AI Reliability: UK Mean (SD): UK (UK)	Construct: Life satisfaction Scale: SWLS Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.095 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of fame Scale: AI Reliability: UK Mean (SD): UK (UK)	Construct: Life satisfaction Scale: SWLS Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= -0.194 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
	Construct: Importance of image Scale: AI Reliability: UK Mean (SD): UK (UK)	Construct: Life satisfaction Scale: SWLS Reliability: UK Mean (SD): UK (UK)	Unadjusted: r= 0.010 (NS) Adjusted: None	E misclass D misclass Confounder control	Mod Mod None
Vansteenkiste 2006 n=148	Construct: Importance of financial success Scale: AI Reliability: 0.73 Mean (SD): Business students: 5.76, Education students: 2.80 (BS: 0.56, ES: 0.93)	Construct: Summary well-being (standardized scores) Scale: Summary of standardized scales: SWLS, SVS Reliability: 0.94 (SWLS) & 0.96 (SVS) Mean (SD): UK (UK)	Unadjusted: r= -0.21 (p<0.001) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of fame Scale: AI Reliability: 0.73 Mean (SD): Business students: 2.22, Education students: 1.54 (BS: 1.42, ES: 0.61)	Construct: Summary well-being (standardized scores) Scale: Summary of standardized scales: SWLS, SVS Reliability: 0.94 (SWLS) & 0.96 (SVS) Mean (SD): UK (UK)	Unadjusted: r= -0.15 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of image Scale: AI Reliability: 0.73 Mean (SD): Business students: 4.06, Education students: 2.25 (BS: 1.00, ES: 0.90)	Construct: Summary well-being (standardized scores) Scale: Summary of standardized scales: SWLS, SVS Reliability: 0.94 (SWLS) & 0.96 (SVS) Mean (SD): UK (UK)	Unadjusted: r= -0.22 (p<0.001) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of	Construct: Distress	Unadjusted:	E misclass	Low

Study	Materialism measure	Outcome measure	Results	Bias	
	financial success Scale: AI Reliability: 0.73 Mean (SD): Business students: 5.76, Education students: 2.80 (BS: 0.56, ES: 0.93)	Scale: Internal Distress Scale (IDS) Reliability: 0.78 Mean (SD): UK (UK)	r= 0.12 (NS) Adjusted: None	D misclass Confounder control	Mod None
	Construct: Importance of fame Scale: AI Reliability: 0.73 Mean (SD): Business students: 2.22, Education students: 1.54 (BS: 1.42, ES: 0.61)	Construct: Distress Scale: Internal Distress Scale (IDS) Reliability: 0.78 Mean (SD): UK (UK)	Unadjusted: r= 0.10 (NS) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
	Construct: Importance of image Scale: AI Reliability: 0.73 Mean (SD): Business students: 4.06, Education students: 2.25 (BS: 1.00, ES: 0.90)	Construct: Distress Scale: Internal Distress Scale (IDS) Reliability: 0.78 Mean (SD): UK (UK)	Unadjusted: r= 0.13 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.94 Mean (SD): Business students: 4.01, Education students: 2.20 (BS: 0.87, ES: 0.69)	Construct: Summary well-being (standardized scores) Scale: Summary of standardized scales: SWLS, SVS Reliability: 0.94 (SWLS) & 0.96 (SVS) Mean (SD): UK (UK)	Unadjusted: r= -0.22 (p<0.001) Adjusted: None	E misclass D misclass Confounder control	Low Low None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.94 Mean (SD): Business students: 4.01, Education students: 2.20 (BS: 0.87, ES: 0.69)	Construct: Distress Scale: Internal Distress Scale (IDS) Reliability: 0.78 Mean (SD): UK (UK)	Unadjusted: r= 0.13 (p<0.05) Adjusted: None	E misclass D misclass Confounder control	Low Mod None
	Construct: Relative importance of intrinsic to extrinsic values Scale: AI Reliability: UK Mean (SD): UK (UK)	Construct: Summary well-being (standardized scores) Scale: Summary of standardized scales: SWLS, SVS Reliability: 0.94 (SWLS) & 0.96 (SVS) Mean (SD): UK (UK)	Unadjusted: None Adjusted: Unstd beta= 0.34 (p<0.01) Adjusted for: gender, school department (business vs. educ.)	E misclass D misclass Confounder control	Mod Low Mod
	Construct: Relative importance of intrinsic to extrinsic values Scale: AI Reliability: UK Mean (SD): UK (UK)	Construct: Distress Scale: Internal Distress Scale (IDS) Reliability: 0.78 Mean (SD): UK (UK)	Unadjusted: None Adjusted: Unstd beta= -0.34 (p<0.01) Adjusted for: gender, school department (business vs. educ.)	E misclass D misclass Confounder control	Mod Mod Mod
Wheeler 1990 n=115	Construct: Importance of financial success	Construct: General well-being Scale: General Well-Being	Unadjusted: d= -0.43 (p<0.05)	E misclass D misclass	High High

Study	Materialism measure	Outcome measure	Results	Bias	
	Scale: Life Esteem Survey Reliability: 0.61-0.78 Mean (SD): High WB: 5.1 (2.4), Low WB: 6.1 (2.2)	Questionnaire Reliability: UK Mean (SD): UK (UK)	Adjusted: None	Confounder control	None
	Construct: Importance of superiority over others Scale: Life Esteem Survey Reliability: 0.61-0.78 Mean (SD): High WB: 2.8 (2.3), Low WB: 4.4 (2.6)	Construct: General well-being Scale: General Well-Being Questionnaire Reliability: UK Mean (SD): UK (UK)	Unadjusted: d= -0.66 (p<0.05) Adjusted: None	E misclass	High
				D misclass	High
				Confounder control	None
Yamaguchi 2012 n=97	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.82-0.89 Mean (SD): 4.35 (0.82)	Construct: Anxiety Scale: State-Trait Anxiety Inventory (STAI) Reliability: 0.71 Mean (SD): 1.71 (0.44)	Unadjusted: r= 0.13 (p>0.001, but unclear if <0.05) Adjusted: None	E misclass	Low
				D misclass	Low
				Confounder control	None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.82-0.89 Mean (SD): 4.35 (0.82)	Construct: Depression Scale: CES-D Reliability: 0.9 Mean (SD): 13.49 (9.29)	Unadjusted: r= 0.23 (p>0.001, but unclear if <0.05) Adjusted: None	E misclass	Low
				D misclass	Low
				Confounder control	None
	Construct: Importance of materialistic (extrinsic) goals Scale: AI Reliability: 0.82-0.89 Mean (SD): 4.35 (0.82)	Construct: Affect balance Scale: PANAS Reliability: 0.82 (positive affect), 0.83 (negative affect) Mean (SD): UK (UK)	Unadjusted: r= -0.06 (NS) Adjusted: None	E misclass	Low
				D misclass	Low
				Confounder control	None

Materialism measures: AI=Aspirations Index, MVS=Material Values Scale, PVQ=Portrait Values Questionnaire, SVS=Schwartz Values Schedule

Outcome measures: CES-D=Center for Epidemiological Studies Depression Survey, DICA=Diagnostic Interview for Children and Adolescents, ISA= Index of Self-Actualization, PANAS=Positive and Negative Affect Scales, SVS=Subjective Vitality Scale

6.2 Appendices for the Materialism and Health paper (Chapter 3)

6.2.1 Materialism scale

The following scale was used in the Longitudinal Study of Generations to measure the humanism-materialism dimension of the modified Rokeach Values Survey[93] developed by Bengtson and Lovejoy.[174] Items 1i and 2i were included in Waves 2, 3, 6, 7, and 8. In order to compare materialism scores across waves, the 9-item rankings were recoded to reflect ranking of 8 items; the order of the rankings was preserved, but the actual rank may have changed. The additional items were not part of the materialism/humanism dimension.

We would like to know your ranking of personal values. Below is a list of things people might find important in their lives. Some of these will be more important to you than others.

1. First, read through the list of nine items. Then tell us the order in which you would rank them. Write "1" to the right of the thing that is MOST IMPORTANT to you. Write "2" next to the SECOND most important thing, "3" next to the THIRD, and so on. When you have finished you will have numbered these from 1 to 9, in order of importance to you.	Order of importance	2. Here is a second list of nine values in life. Please rank order these characteristics the same way you did on the previous question. These all may be important; but we want to know which YOU think are the MOST desirable. When you have finished you will have numbered these from 1 to 9, in order of importance to you.	Order of importance
a. An exciting life (novelty, adventure)	_____	a. An attractive appearance (knowing others admire the way you look)	_____
b. Equality (working for social justice for all)	_____	b. A world at peace (working for peace on earth)	_____
c. A sense of accomplishment (achievement)	_____	c. Loyalty to your own (family and loved ones, church or group)	_____
d. Financial comfort (enough to have the things you really want in life)	_____	d. An ethical life (responsible living toward all	_____
e. Respect or recognition from other people	_____	e. Possessions (enough things so you can do what you really enjoy doing)	_____
f. Religious participation (working with others in your own church or organization)	_____	f. Patriotism (working for our country)	_____
g. Service (devotion to bettering mankind)	_____	g. Personal freedom (independence, free choice, autonomy)	_____
h. Friendship (meaningful relations with others who really care)	_____	h. Skill (being good at something you enjoy doing)	_____
i. Family life (working for the well-being of family members)	_____	i. Career advancement (achieving success in your job or profession)	_____

Materialism items (4 items) are marked with solid-border boxes. Shaded boxes with dashed borders highlight humanism items (4 items).

6.2.2 Bradburn Affect Balance Scale

The Bradburn Affect Balance Scale[149] is used to measure psychological well-being by calculating the difference in positive and negative affect item scores. Respondents were asked "During the past few weeks, did you ever feel…" for each of 10 scale items; items alternated for positive affect (e.g., "on top of the world?") and negative affect (e.g., "depressed or very unhappy?").

Bradburn Affect Balance Scale

Positive affect items	Negative affect items
Particularly excited or interested in something?	So restless that you couldn't sit long in a chair?
Proud because someone complimented you on something you had done?	Very lonely or remote from other people?
Pleased about having accomplished something?	Bored?
On top of the world?	Depressed or very unhappy?
That things were really going your way?	Upset because someone criticized you?

6.2.3 Rotter's Locus of control

Locus of control was measured with three items[136] in which respondents selected the statement that "more closely [represented their] attitude at this point in life.". One point was assigned when the internal locus of control statement was chosen so that overall control scores ranged from 0-3; higher scores signal the respondent felt greater control over his or her life.

Locus of control items and scoring

	Internal locus of control (1 point)		External locus of control (0 points)
1.	When I make plans, I am almost certain that I can make them work.	OR	It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.
2.	It is impossible for me to believe that chance or luck plays an important role in my life.	OR	Many times I feel that I have little influence over the things that happen to me.
3.	Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.	OR	I have often found that what is going to happen will happen.

6.2.4 Total effects models

This section provides partially adjusted models building up to the adjusted models presented in the main tables.

Partially adjusted total effects models

		Self-reported health									Any chronic medical condition								
		Demographics			+Socioeconomics			+Study year			Demographics			+Socioeconomics			+Study year		
		RR	95% CI		RR	95% CI		RR	95% CI		RR	95% CI		RR	95% CI		RR	95% CI	
Materialism		0.99	0.93	1.05	0.98	0.92	1.04	0.98	0.92	1.05	1.02	0.98	1.06	1.01	0.97	1.05	1.02	0.98	1.06
Age	*<34 years*	**Reference**			**Reference**			**Reference**			**Reference**			**Reference**			**Reference**		
	35-49 years	**0.96**	**0.82**	**1.13**	**1.07**	**0.89**	**1.28**	**1.07**	**1.07**	**1.07**	**1.55**	**1.24**	**1.92**	**1.55**	**1.24**	**1.93**	**1.25**	**1.00**	**1.57**
	50-64 years	**0.90**	**0.74**	**1.11**	**0.96**	**0.78**	**1.19**	**1.07**	**1.07**	**1.07**	**2.34**	**1.86**	**2.94**	**2.31**	**1.83**	**2.93**	**2.01**	**1.58**	**2.55**
	65+ years	**1.35**	**1.11**	**1.62**	**1.34**	**1.10**	**1.64**	**1.07**	**1.07**	**1.07**	**3.08**	**2.47**	**3.85**	**3.00**	**2.40**	**3.74**	**2.40**	**1.90**	**3.03**
Male		0.87	0.74	1.04	0.98	0.82	1.16	0.98	0.82	1.17	0.94	0.86	1.02	0.98	0.89	1.07	0.99	0.90	1.08
Education	*Some high school*				**Reference**			**Reference**						Reference			**Reference**		
	HS graduate				**0.89**	**0.74**	**1.07**	**0.85**	**0.71**	**1.03**				0.98	0.86	1.12	**0.94**	**0.83**	**1.08**
	Some college/technical				**0.81**	**0.67**	**0.97**	**0.76**	**0.63**	**0.93**				1.02	0.90	1.15	**0.97**	**0.85**	**1.10**
	College graduate				**0.66**	**0.51**	**0.86**	**0.61**	**0.47**	**0.79**				0.96	0.82	1.13	**0.89**	**0.76**	**1.04**
	Graduate school				**0.63**	**0.47**	**0.84**	**0.59**	**0.44**	**0.79**				0.89	0.76	1.05	**0.84**	**0.71**	**0.98**
Prior Household income	*Lowest quartile*				**Reference**			**Reference**						**Reference**			**Reference**		
	2nd quartile				**0.82**	**0.71**	**0.95**	**0.82**	**0.71**	**0.95**				**0.97**	**0.89**	**1.07**	**0.97**	**0.89**	**1.07**
	3rd quartile				**0.76**	**0.65**	**0.90**	**0.77**	**0.65**	**0.91**				**0.94**	**0.85**	**1.05**	**0.95**	**0.86**	**1.05**
	Highest quartile				**0.70**	**0.58**	**0.85**	**0.70**	**0.58**	**0.85**				**0.87**	**0.77**	**0.98**	**0.87**	**0.77**	**0.98**
Year (materialism measure)	*1985*							**Reference**									**Reference**		
	1988							**1.10**	**0.94**	**1.30**							**1.22**	**1.07**	**1.39**
	1991							**1.30**	**1.10**	**1.53**							**1.41**	**1.26**	**1.57**
	1994							**1.04**	**0.87**	**1.25**							**1.42**	**1.27**	**1.59**
	1997							**1.25**	**1.04**	**1.51**							**1.42**	**1.27**	**1.59**
	2000							**1.36**	**1.14**	**1.62**							**1.54**	**1.38**	**1.73**

Bold cells are significant (p<0.05). Shaded variables or values were not included in the model.

6.2.5 Mediation models

Below are mediation models testing each mediator alone: household income, competence, and control. Household income was hypothesized as an inconsistent mediator. All mediators were measured in Waves 3, 4, and 8; therefore, year of study was limited (shaded in grey).

		Self-reported health									Any chronic medical condition								
		Household income			Competence			Control			Household income			Competence			Control		
		RR	95% CI		RR	95% CI		RR	95% CI		RR	95% CI		RR	95% CI		RR	95% CI	
Materialism		0.99	0.90	1.09	0.98	0.89	1.07	0.98	0.89	1.08	1.04	0.98	1.09	1.02	0.97	1.08	1.02	0.97	1.08
Age	*<34 years*	**Reference**			Reference			**Reference**			**Reference**			**Reference**			**Reference**		
	35-49 years	**1.04**	**0.83**	**1.30**	0.94	0.75	1.17	**1.03**	**0.83**	**1.29**	**1.30**	**1.00**	**1.69**	**1.29**	**0.99**	**1.69**	**1.28**	**0.99**	**1.65**
	50-64 years	**1.08**	**0.84**	**1.39**	1.03	0.80	1.32	**1.16**	**0.89**	**1.50**	**2.02**	**1.54**	**2.67**	**2.06**	**1.55**	**2.72**	**2.06**	**1.57**	**2.70**
	65+ years	**1.35**	**1.03**	**1.77**	1.29	0.99	1.68	**1.42**	**1.09**	**1.86**	**2.64**	**2.01**	**3.47**	**2.73**	**2.09**	**3.58**	**2.69**	**2.08**	**3.49**
Male		1.19	0.98	1.45	1.18	0.97	1.42	**1.24**	**1.02**	**1.50**	1.05	0.94	1.17	1.05	0.94	1.17	1.06	0.95	1.19
Education	*Some high school*	**Reference**			**Reference**			**Reference**			Reference			Reference			Reference		
	HS graduate	**0.86**	**0.66**	**1.12**	**0.81**	**0.62**	**1.04**	**0.80**	**0.62**	**1.04**	0.95	0.79	1.14	0.95	0.79	1.15	0.98	0.81	1.18
	Some college/technical	**0.73**	**0.56**	**0.95**	**0.68**	**0.53**	**0.88**	**0.68**	**0.53**	**0.88**	0.97	0.82	1.15	0.96	0.81	1.15	0.97	0.81	1.16
	College graduate	**0.58**	**0.41**	**0.82**	**0.56**	**0.40**	**0.78**	**0.53**	**0.38**	**0.76**	0.90	0.71	1.13	0.88	0.69	1.11	0.90	0.71	1.14
	Graduate school	**0.65**	**0.44**	**0.97**	**0.59**	**0.40**	**0.88**	**0.58**	**0.39**	**0.86**	0.87	0.70	1.07	0.83	0.68	1.02	0.85	0.68	1.05
Prior Household income	*Lowest quartile*	Reference			**Reference**			**Reference**			Reference			**Reference**			**Reference**		
	2nd quartile	0.93	0.75	1.15	**0.86**	**0.70**	**1.06**	**0.91**	**0.74**	**1.12**	0.97	0.85	1.12	**0.93**	**0.81**	**1.06**	**0.93**	**0.81**	**1.06**
	3rd quartile	0.93	0.75	1.15	**0.81**	**0.66**	**0.99**	**0.82**	**0.67**	**1.01**	1.02	0.88	1.18	**0.93**	**0.82**	**1.06**	**0.93**	**0.82**	**1.06**
	Highest quartile	0.82	0.62	1.08	**0.70**	**0.54**	**0.90**	**0.70**	**0.55**	**0.91**	0.92	0.78	1.09	**0.82**	**0.71**	**0.95**	**0.83**	**0.72**	**0.97**
Negative affect		**1.14**	**1.04**	**1.24**	**1.11**	**1.01**	**1.21**	**1.13**	**1.04**	**1.23**	**1.10**	**1.05**	**1.16**	**1.10**	**1.05**	**1.16**	**1.10**	**1.05**	**1.16**
Year (materialism measure)	*1985*	**Reference**			**Reference**			**Reference**			**Reference**			**Reference**			**Reference**		
	1988	**1.12**	**0.94**	**1.34**	**1.19**	**1.00**	**1.42**	**1.21**	**1.01**	**1.44**	**1.24**	**1.08**	**1.43**	**1.27**	**1.11**	**1.46**	**1.29**	**1.13**	**1.49**
	1991																		
	1994																		
	1997																		
	2000	**1.33**	**1.09**	**1.62**	**1.25**	**1.03**	**1.52**	**1.43**	**1.18**	**1.73**	**1.53**	**1.35**	**1.74**	**1.51**	**1.33**	**1.70**	**1.58**	**1.39**	**1.79**
Mediating Household income	*Lowest quartile*	**Reference**									**Reference**								
	2nd quartile	**0.85**	**0.70**	**1.04**							**0.91**	**0.81**	**1.03**						
	3rd quartile	**0.73**	**0.57**	**0.92**							**0.81**	**0.70**	**0.94**						
	Highest quartile	**0.59**	**0.43**	**0.81**							**0.80**	**0.67**	**0.96**						
Competence					**0.79**	**0.73**	**0.85**							0.96	0.91	1.00			
Control								**0.71**	**0.60**	**0.84**							**0.85**	**0.77**	**0.94**

Bold cells are significant ($p<0.05$). Shaded variables or values were not included in the model.

6.2.6 Effect modification on the multiplicative scale

	Self-reported health						Any chronic medical condition					
	Household income			Education			Household income			Education		
	RR	95% CI		RR	95% CI		RR	95% CI		RR	95% CI	
Materialism	0.98	0.89	1.07	0.93	0.77	1.12	0.98	0.93	1.03	0.99	0.90	1.08
Age												
<34 years	**Reference**			Reference			**Reference**			**Reference**		
35-49 years	**1.06**	**0.88**	**1.27**	0.96	0.80	1.15	**1.31**	**1.05**	**1.65**	**1.25**	**1.00**	**1.57**
50-64 years	**1.03**	**0.83**	**1.27**	0.92	0.73	1.15	**2.15**	**1.69**	**2.75**	**2.04**	**1.60**	**2.61**
65+ years	**1.36**	**1.10**	**1.68**	1.21	0.97	1.50	**2.59**	**2.04**	**3.28**	**2.47**	**1.94**	**3.14**
Male	0.99	0.83	1.18	1.00	0.84	1.19	1.01	0.92	1.11	1.00	0.91	1.10
Education												
Some high school	**Reference**			**Reference**			Reference			**Reference**		
HS graduate	**0.88**	**0.73**	**1.06**	**0.77**	**0.60**	**1.00**	0.95	0.83	1.08	**0.89**	**0.78**	**1.01**
Some college/technical	**0.80**	**0.66**	**0.96**	**0.68**	**0.54**	**0.86**	0.97	0.85	1.11	**0.88**	**0.78**	**1.00**
College graduate	**0.62**	**0.47**	**0.80**	**0.55**	**0.41**	**0.73**	0.89	0.76	1.05	**0.78**	**0.66**	**0.92**
Graduate school	**0.62**	**0.47**	**0.83**	**0.54**	**0.39**	**0.74**	0.85	0.72	1.00	**0.76**	**0.65**	**0.90**
Household income												
Lowest quartile	**Reference**			**Reference**			**Reference**			**Reference**		
2nd quartile	**0.89**	**0.77**	**1.04**	**0.82**	**0.71**	**0.96**	**0.97**	**0.89**	**1.06**	**0.98**	**0.89**	**1.08**
3rd quartile	**0.83**	**0.70**	**0.99**	**0.77**	**0.65**	**0.91**	**0.92**	**0.83**	**1.02**	**0.96**	**0.87**	**1.06**
Highest quartile	**0.69**	**0.55**	**0.85**	**0.71**	**0.58**	**0.87**	**0.83**	**0.73**	**0.94**	**0.88**	**0.78**	**1.00**
Negative affect	**1.09**	**1.02**	**1.16**	**1.10**	**1.03**	**1.17**	**1.08**	**1.04**	**1.13**	**1.09**	**1.05**	**1.13**
Year of study												
1985	**Reference**			**Reference**			**Reference**			**Reference**		
1988	**1.15**	**0.97**	**1.36**	**1.05**	**0.89**	**1.24**	**1.24**	**1.09**	**1.42**	**1.25**	**1.10**	**1.43**
1991	**1.29**	**1.08**	**1.53**	**1.27**	**1.07**	**1.51**	**1.42**	**1.27**	**1.58**	**1.43**	**1.28**	**1.60**
1994	**1.08**	**0.90**	**1.31**	**1.03**	**0.86**	**1.24**	**1.45**	**1.29**	**1.63**	**1.45**	**1.29**	**1.63**
1997	**1.32**	**1.09**	**1.60**	**1.22**	**1.01**	**1.48**	**1.47**	**1.30**	**1.65**	**1.46**	**1.30**	**1.65**
2000	**1.48**	**1.23**	**1.77**	**1.34**	**1.12**	**1.60**	**1.59**	**1.41**	**1.79**	**1.59**	**1.41**	**1.78**
Materialism* income												
Lowest quartile	Reference						Reference					
2nd quartile	1.03	0.91	1.17				1.06	0.98	1.14			
3rd quartile	1.01	0.87	1.17				1.07	0.98	1.16			
Highest quartile	1.01	0.84	1.22				1.03	0.93	1.15			
Materialism*education												
Some high school				Reference						Reference		
HS graduate				1.06	0.86	1.30				1.02	0.92	1.14
Some college/technical				1.05	0.85	1.31				1.06	0.95	1.17
College graduate				1.02	0.79	1.32				0.98	0.85	1.13
Graduate school				1.09	0.82	1.45				1.03	0.90	1.18

Confounding variables for education and household income were measured at time 0, i.e. the wave before materialism was measured. Effect modification variables for education and household income were measured concurrently with materialism at time t. Bold cells are significant ($p<0.05$). Shaded variables or values were not included in the model.

6.2.7 Effect modification on the additive scale: Relative excess risk due to interaction (RERI) and attributable proportion due to interaction (AP)

	Self-reported health		Any chronic medical condition	
	Estimate	**95% CI**	**Estimate**	**95% CI**
RERI				
Materialism* income				
Lowest quartile	Reference		Reference	
2nd quartile	0.03	(-0.18, 0.23)	0.06	(-0.09, 0.20)
3rd quartile	0.01	(-0.22, 0.24)	0.06	(-0.09, 0.21)
Highest quartile	0.02	(-0.22, 0.25)	0.03	(-0.13, 0.19)
Materialism*education				
Some high school	Reference		Reference	
HS graduate	0.06	(-0.30, 0.42)	0.02	(-0.18, 0.22)
Some college/technical	0.06	(-0.29, 0.40)	0.05	(-0.16, 0.26)
College graduate	0.04	(-0.28, 0.36)	-0.01	(-0.22, 0.19)
Graduate school	0.08	(-0.27, 0.42)	0.03	(-0.19, 0.24)
AP				
Materialism* income				
Lowest quartile	Reference		Reference	
2nd quartile	0.03	(-0.19, 0.26)	0.06	(-0.08, 0.20)
3rd quartile	0.01	(-0.26, 0.29)	0.06	(-0.09, 0.22)
Highest quartile	0.02	(-0.31, 0.36)	0.04	(-0.15, 0.22)
Materialism*education				
Some high school	Reference		Reference	
HS graduate	0.08	(-0.38, 0.54)	0.02	(-0.20, 0.24)
Some college/technical	0.08	(-0.42, 0.59)	0.06	(-0.17, 0.28)
College graduate	0.08	(-0.52, 0.68)	-0.02	(-0.29, 0.26)
Graduate school	0.14	(-0.46, 0.74)	0.04	(-0.24, 0.31)

Estimates were adjusted for age, gender, prior household income or education, prior negative affect, and year of study. Bold cells are significant ($p<0.05$).

6.2.8 Sensitivity analyses for self-reported health: Adjusted models

	Social desirability			Importance of materialistic items			Importance of financial comfort			Youngest respondents (born 1970s-1980s)‡		
	RR	95% CI		RR	95% CI		RR	95% CI		RR	95% CI	
Materialism												
Original scale	0.96	0.90	1.03							**1.59**	**1.25**	**2.01**
Materialistic items only				1.02	0.96	1.09						
Financial comfort only							1.02	0.96	1.09			
Social desirability	1.09	0.97	1.22									
Age												
<34 years	Reference			Reference			Reference					
35-49 years	0.97	0.75	1.25	**1.05**	**0.88**	**1.26**	**1.05**	**0.88**	**1.26**			
50-64 years	0.97	0.72	1.31	**1.01**	**0.81**	**1.26**	**1.01**	**0.81**	**1.26**			
65+ years	1.27	0.92	1.76	**1.34**	**1.08**	**1.65**	**1.34**	**1.08**	**1.65**			
Male	1.07	0.86	1.33	1.00	0.84	1.19	1.00	0.84	1.19	**0.51**	**0.30**	**0.86**
Education												
Some high school	Reference			Reference			Reference			Reference		
HS graduate	**0.92**	**0.73**	**1.16**	**0.86**	**0.71**	**1.05**	**0.86**	**0.71**	**1.04**	1.20	0.68	2.14
Some college/technical	**0.81**	**0.65**	**1.01**	**0.77**	**0.63**	**0.93**	**0.76**	**0.63**	**0.92**	1.53	0.66	3.56
College graduate	**0.62**	**0.45**	**0.85**	**0.60**	**0.46**	**0.78**	**0.60**	**0.46**	**0.78**	0.62	0.39	1.00
Graduate school§	**0.66**	**0.46**	**0.94**	**0.59**	**0.44**	**0.80**	**0.59**	**0.44**	**0.80**			
Household income												
Lowest quartile	Reference			Reference			Reference			Reference		
2nd quartile	**0.80**	**0.68**	**0.94**	**0.82**	**0.71**	**0.95**	**0.82**	**0.71**	**0.95**	1.01	0.49	2.05
3rd quartile	**0.73**	**0.60**	**0.88**	**0.76**	**0.65**	**0.90**	**0.76**	**0.65**	**0.90**	1.70	0.98	2.94
Highest quartile	**0.68**	**0.54**	**0.86**	**0.70**	**0.57**	**0.85**	**0.69**	**0.57**	**0.85**	0.63	0.29	1.40
Negative affect	1.07	0.99	1.15	**1.10**	**1.03**	**1.17**	**1.10**	**1.03**	**1.17**	1.21	0.95	1.55
Year of study												
1985	Reference			Reference			Reference					
1988	**1.10**	**0.92**	**1.31**	**1.15**	**0.97**	**1.36**	**1.17**	**0.99**	**1.38**			
1991	**1.35**	**1.12**	**1.62**	**1.34**	**1.13**	**1.58**	**1.34**	**1.13**	**1.59**			
1994	**1.06**	**0.85**	**1.31**	**1.06**	**0.88**	**1.28**	**1.07**	**0.89**	**1.29**	Reference		
1997	**1.26**	**1.02**	**1.57**	**1.30**	**1.07**	**1.58**	**1.31**	**1.08**	**1.58**	1.23	0.67	2.24
2000	**1.44**	**1.18**	**1.76**	**1.41**	**1.18**	**1.70**	**1.42**	**1.18**	**1.70**	1.03	0.54	1.97

§Graduate school and college graduate categories were collapsed for the youngest respondents analysis due to sparse cells.
‡ The youngest respondents were <34 years and only participated in later waves; therefore, age was excluded and only some waves were included in the model. Bold cells are significant (p<0.05). Shaded variables or values were not included in the model.

6.2.9 Sensitivity analyses for chronic medical conditions: Adjusted models

	Social desirability			Importance of materialistic items			Importance of financial comfort		
	RR	95% CI		RR	95% CI		RR	95% CI	
Materialism									
Original scale	1.02	0.97	1.06						
Materialistic items only				1.02	0.96	1.09			
Financial comfort only							**1.04**	**1.00**	**1.08**
Social desirability	1.02	0.97	1.08						
Age									
<34 years	**Reference**			**Reference**			**Reference**		
35-49 years	**1.30**	**1.00**	**1.69**	**1.05**	**0.88**	**1.26**	**1.29**	**1.03**	**1.61**
50-64 years	**2.19**	**1.66**	**2.88**	**1.01**	**0.81**	**1.26**	**2.12**	**1.67**	**2.70**
65+ years	**2.64**	**2.02**	**3.44**	**1.34**	**1.08**	**1.65**	**2.57**	**2.03**	**3.26**
Male	1.00	0.90	1.12	1.00	0.84	1.19	1.00	0.91	1.09
Education									
Some high school	Reference			**Reference**			**Reference**		
HS graduate	0.92	0.80	1.06	**0.86**	**0.71**	**1.05**	**0.93**	**0.82**	**1.06**
Some college/technical	0.93	0.81	1.07	**0.77**	**0.63**	**0.93**	**0.95**	**0.84**	**1.08**
College graduate	0.87	0.73	1.04	**0.60**	**0.46**	**0.78**	**0.87**	**0.74**	**1.02**
Graduate school	0.85	0.71	1.01	**0.59**	**0.44**	**0.80**	**0.82**	**0.70**	**0.97**
Household income									
Lowest quartile	**Reference**			**Reference**			**Reference**		
2nd quartile	**0.97**	**0.88**	**1.07**	**0.82**	**0.71**	**0.95**	**0.97**	**0.89**	**1.07**
3rd quartile	**0.94**	**0.85**	**1.05**	**0.76**	**0.65**	**0.90**	**0.95**	**0.86**	**1.05**
Highest quartile	**0.85**	**0.75**	**0.97**	**0.70**	**0.57**	**0.85**	**0.86**	**0.77**	**0.97**
Negative affect	**1.07**	**1.02**	**1.11**	**1.10**	**1.03**	**1.17**	**1.08**	**1.04**	**1.12**
Year of study									
1985	**Reference**			**Reference**			**Reference**		
1988	**1.24**	**1.09**	**1.41**	**1.15**	**0.97**	**1.36**	**1.25**	**1.09**	**1.42**
1991	**1.43**	**1.28**	**1.60**	**1.34**	**1.13**	**1.58**	**1.44**	**1.29**	**1.60**
1994	**1.43**	**1.28**	**1.60**	**1.06**	**0.88**	**1.28**	**1.45**	**1.29**	**1.62**
1997	**1.43**	**1.27**	**1.62**	**1.30**	**1.07**	**1.58**	**1.46**	**1.30**	**1.64**
2000	**1.58**	**1.40**	**1.78**	**1.41**	**1.18**	**1.70**	**1.57**	**1.40**	**1.76**

Bold cells are significant ($p<0.05$). Shaded variables or values were not included in the model.

6.3 Appendices for the Materialism and Mortality paper (Chapter 4)

6.3.1 Sensitivity analyses: Adjusted models

	Social desirability			Importance of materialistic items			Importance of financial comfort		
	HR	95% CI		HR	95% CI		HR	95% CI	
Materialism									
Original scale	1.33	0.80	2.22						
Materialistic items only				1.27	0.76	2.11			
Financial comfort only							0.98	0.55	1.75
Social desirability	1.10	0.95	1.29						
Male	**1.95**	**1.55**	**2.45**	**1.97**	**1.58**	**2.47**	**1.98**	**1.59**	**2.48**
Education									
Some high school	**Reference**			Reference			Reference		
HS graduate	**0.62**	**0.30**	**1.28**	0.70	0.34	1.46	0.68	0.33	1.43
Some college/technical	**0.34**	**0.09**	**1.23**	0.43	0.12	1.57	0.41	0.11	1.50
College graduate	**0.10**	**0.01**	**0.73**	0.14	0.02	1.09	0.13	0.02	1.01
Graduate school	**0.08**	**0.01**	**0.94**	0.12	0.01	1.34	0.11	0.01	1.21
Household income									
Lowest quartile	Reference			Reference			Reference		
2nd quartile	2.28	0.90	5.78	2.12	0.83	5.41	2.12	0.83	5.41
3rd quartile	4.60	0.81	26.13	4.21	0.75	23.77	4.19	0.74	23.68
Highest quartile	6.80	0.62	73.99	5.95	0.54	65.42	5.97	0.54	66.16

Bold cells are significant ($p<0.05$). Shaded variables or values were not included in the model.